I. C. 7082

JUNE 1939

UNITED STATES
DEPARTMENT OF THE INTERIOR
HAROLD L. ICKES, SECRETARY

BUREAU OF MINES
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INFORMATION CIRCULAR

RECONNAISSANCE OF PLACER-MINING DISTRICTS IN LEMHI COUNTY, IDAHO

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BY

S. H. LORAIN AND O. H. METZGER

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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

RECONNAISSANCE OF PLACER-MINING DISTRICTS IN LEMHI COUNTY, IDAHO[1]

By S. H. Lorain[2] and O. H. Metzger[3]

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[1] The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7082."

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INTRODUCTION

This paper briefly describes the principal commercial and near-commercia deposits of gold-bearing gravel and the important placer-mining operations in Lemhi County, Idaho. It is one of a series on western mining districts being published by the Bureau of Mines.

This paper is based on a field survey of the placer-mining districts of Lemhi County in the summer of 1938. Available information concerning gold-bearing gravels was obtained from prospectors and claim owners; operators supplied the data on mining operations. No attempt was made actually to test the gravels. The principal object of the examination was to indicate placer areas worthy of further investigation by prospective operators.

Since 1866 Lemhi County has been an important producer of placer gold. Although production has not been as large as that from some other Idaho counties, at least a few men have made a good living from placer mining in the county each season since 1866. Partly because of its relative isolation and partly for other reasons to be discussed later, the Lemhi County placers have not been worked so intensively and have not become so nearly exhausted as have the deposits in many better-known placer-mining regions.

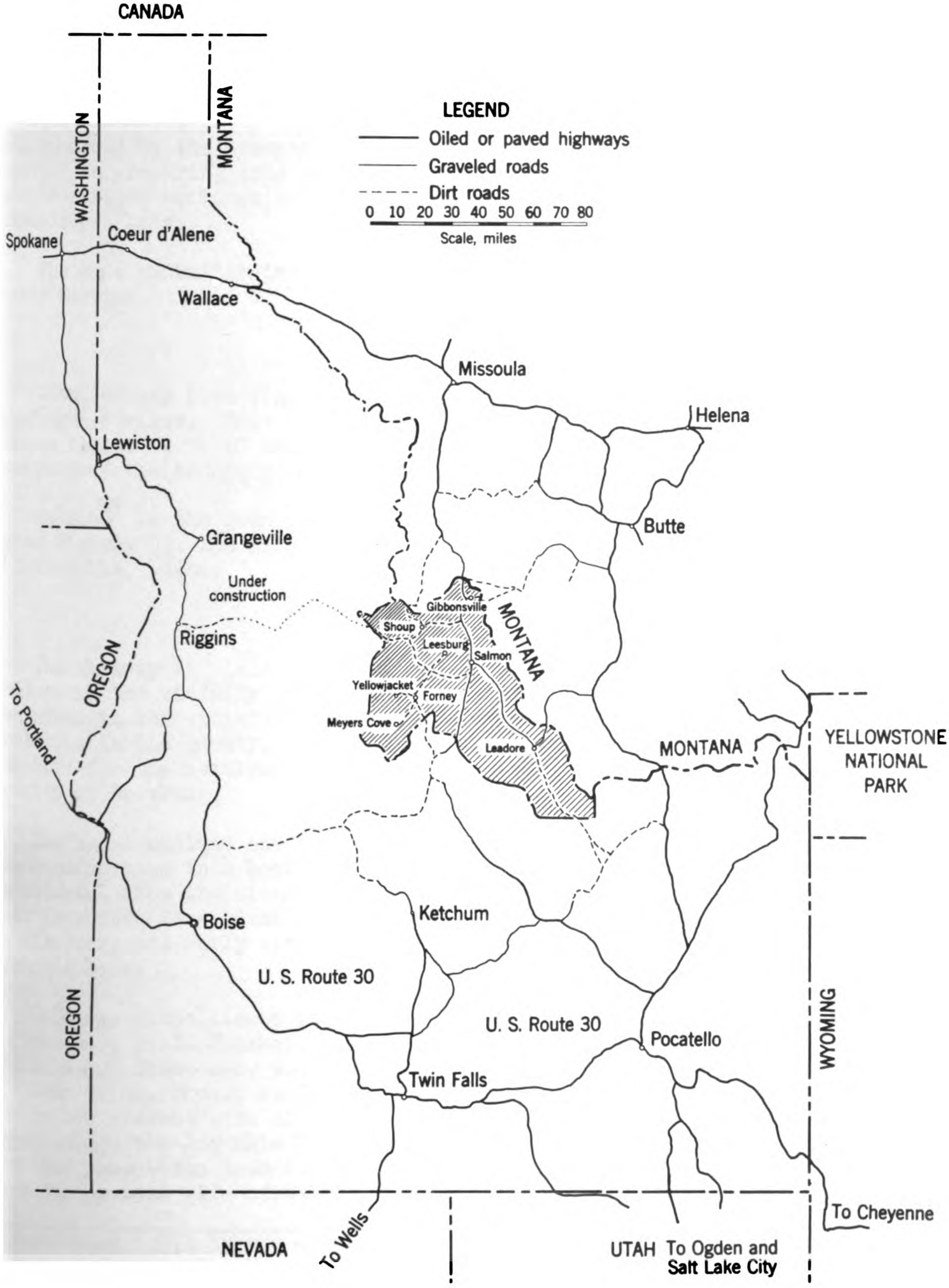

Figure 1.–Key map, Lemhi County, Idaho. showing principal road connections with adjacent territory.

ACKNOWLEDGMENTS

The authors wish to express their thanks for the whole-hearted cooperation rendered by the prospectors, operators, and other residents of Lemhi County. In preparing some sections of the paper, frequent reference was made to earlier writings and to other sources of information, which will be acknowledged later.

The maps shown herein are based on maps supplied by the United States Forest Service.

LOCATION

Lemhi County (see fig. 1) is in east-central Idaho and has an area of 4,597 square miles. Most of it lies between longitudes 113 and 115 west and between latitudes 44-30 and 45-30 north; its northern and eastern boundaries form part of the boundary between Idaho and Montana.

Salmon[4] is the county seat and largest town. It is situated on United States Highway 93, 138 miles south of Missoula, Mont., and 268 miles north of Twin Falls, Idaho.

HISTORY OF PLACER MINING

The history of placer mining in Lemhi County deals mainly with activities in the vicinity of Leesburg Basin. Although some placer gold has been mined in the vicinity of Salmon and Gibbonsville and in other scattered localities in the county, almost all of the early production, which was responsible for the settlement and development of the region, came from the vicinity of Leesburg.

The broad outline and many of the details of Leesburg's early history have been covered in a book by O. E. Kirkpatrick[5] of Leesburg, who obtained his material from the discoverers and first settlers of the camp or from their immediate descendants. That part of the following account dealing with the discovery and early settlement of Leesburg is abstracted from Kirkpatrick's book.

Gold was first discovered in Lemhi County on July 16, 1866, by a party of five men - F. B. Sharkey, Elijah Mulkey, Joseph Rapp, William Smith, and Ward Girton. These men, who had been working in the Montana gold fields, left Bear Gulch, Mont., on June 1, outfitted at a trading post called Cottonwood on the present site of Deer Lodge, Mont., and crossed the Bitterroot Range through the Big Hole Basin to the North Fork of the Salmon River. They then prospected down the North Fork and up the main Salmon River to above the present site of Salmon City, crossed the mountains to the westward, and came down into a stream called "Napias" (meaning gold or money in the Shoshone language) by the Indians. Here, in a shaft at the mouth of what is now called Wards Gulch, they struck gravel that yielded 1 to 5 dollars to the pan.

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[4] Population 1,371 by the census of 1930.

[5] Kirkpatrick, O. E., History of Leesburg Pioneers: Pyramid Press, Salt Lake City, Utah, 1934, 172 pp.

Shortly after the discovery of gold, the townsite of Leesburg was laid out. As news of the strike spread, miners poured in from Montana and from other parts of Idaho until the population of Leesburg had mounted to an estimated 3,000 people. Other small settlements sprang up in the vicinity. These settlements, together with the miners scattered along the creeks, brought the total population of the Leesburg Basin to about 7,000 people. The principal outlying settlements were Grantsville, just north of Leesburg; Summit City, near the head of Sierra Gulch; and Smithville, near the mouth of Smith Gulch. Although estimated to have had a population of 400 to 500 people each, scarcely a trace remains of these last-named settlements.

The Leesburg mining district was organized August 10, 1866, and the Sierra district was organized a short time after. A copy of the original mining laws of the Leesburg district, now in the possession of Kirkpatrick, states that each miner was entitled to one "gulch" claim, one "bar" claim, and one "hill" claim by right of location; any man or group of men making a new discovery was entitled to one additional claim by right of discovery. A gulch claim was 200 feet in length, running up and down the stream, and from rise of rim rock to rise of rim rock in width; a bar claim was 200 feet front and extended back to the rise of the hill rock; a hill claim was 200 feet front and extended back to the summit of the hill or mountain. Claims were declared to be unworkable from November 1 to June 1, but any claim not being worked on June 1 was forfeited. Thereafter claims had to be worked at least 1 day in every 7, but a man working any one of his claims in the distri could represent them all.

The five men constituting the original discovery party organized a company called the Discovery Company, hired about 20 men, and for about 10 years washed out gold during the summer season. They were said to have made a clean-up each week and when working the richest ground recovered a gold pan two-thirds full or about $30,000 a week.

The Pioneer Mining Co., organized to work claims in the Sierra district employed 73 miners, whom they paid $42 per week each. Their clean-up for the season of 1867 was $58,097.37. These companies, later augmented by othe large operators such as the French Company, which operated on Richardson bar the Leesburg Gold Mining & Milling Co. on California bar below Leesburg, and David McNutt, who operated on Moose Creek, probably mined the greater part of the gold produced in the Leesburg Basin. There were, however, large numbers of individual miners and small groups who mined the bars and gulches fo many years after the first discovery.

Although many miles of ditches were built to bring water to the various diggings, it is apparent that little use was made of machinery in the Leesbu area; so far, no dredge, except the Mullan dredge on Moose Creek, has been operated. Consequently, only those parts of the gravel deposits suitable fo hand or hydraulic operations have been worked intensively. In other words, past operations were confined chiefly to the benches and steeper gulches.

Outside of the Leesburg or Mackinaw district, no large areas of high-grade placer gravels have been discovered in Lemhi County. During the 1890's and early 1900's, there were some large-scale dredging operations, however, on Bohannon and Kirtley Creeks near Salmon and some large hydraulic operations on Kirtley Creek and in the vicinity of Gibbonsville. There were also numerous small hand and hydraulic operations at scattered points throughout the northern part of the county.

In common with most other gold-producing regions, the placer fields of Lemhi County became nearly quiescent during the period of high prices from 1917 to 1930. There was, however, continued small-scale production from the Hockensmith, Richardson, and Moose Creek placers in the Mackinaw district.

Higher gold prices in 1933 brought renewed interest in placer mining in Lemhi County as well as in other gold fields. Many small hand operations were started along the Salmon River and on those parts of the gulch deposits that had not been worked out in the early days. A hydraulic operation was started near Gibbonsville in 1936 or 1937. This was the only large placer operation in the county in 1938. There were, however, a number of well-financed companies in the field obtaining options and testing ground.

PRODUCTION

The early placer production of Leesburg Basin was stated by Kirkpatrick[6] to have been approximately $16,000,000. Kirkpatrick gives as his authority for this estimate John E. Rees, county historian. On the other hand, Umpleby[7] estimates the placer production prior to 1881 at about $6,000,000, of which $5,000,000 was produced from Napias Creek and its tributaries and $1,000,000 from Moose Creek. Umpleby further produces statistics that show that the recorded gold production of Lemhi County from 1881 to 1903, inclusive, was $6,892,542; however, he does not separate placer from lode-gold production in this total. If the same ratio between placer and lode-gold production prevailed from 1881 to 1903 as from 1904 to 1910, the placer production from 1881 to 1903 was approximately $2,000,000. However, an analysis of the statistics for the two periods indicates that in the earlier period the ratio of placer to lode-gold production was about twice that of the latter period. According to this, the placer-gold production for the earlier period would be close to $3,500,000. Adding this to Umpleby's estimate for the period prior to 1881, the total placer production up to 1903 would be $9,500,000. A rough estimate of the yardage worked indicates that even this figure may be high; however, it is probably as dependable as any estimate that could be made.

The following table of placer-gold production in Lemhi County was compiled from records of the Federal Geological Survey and the Federal Bureau of Mines under the direction of C. N. Gerry of the Economics and Statistics Branch of the Bureau of Mines.

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[6] Work cited. See footnote 5.

[7] Umpleby, Joseph B., Geology and Ore Deposits of Lemhi County, Idaho: Geol. Survey Bull. 528, 1913, p. 21.

Placer production of Lemhi County, Idaho, 1901-37

Year	Number of mines	Gold, fine ounces	Value	Silver, fine ounces	Value
1901	9	5,012.00	$103,607	431	$ 258
1902	18	2,856.50	59,044	230	123
1903	14	2,476.62	51,192	240	123
1904	15	2,236.00	46,221	588	338
1905	10	1,440.00	29,768	421	255
1906	9	1,346.98	27,844	129	87
1907	18	1,570.93	32,474	128	84
1908	18	1,730.88	35,780	167	88
1909	6	1,164.30	24,068	111	58
1910	13	772.98	15,979	66	36
1901-10	130	20,607.19	425,977	2,511	1,450
1911	14	1,621.68	33,523	135	72
1912	14	3,922.92	81,094	338	208
1913	12	5,162.29	106,714	451	272
1914	14	7,655.60	158,255	620	342
1915	12	5,714.20	118,123	449	228
1916	11	3,577.67	73,957	295	194
1917	8	2,002.56	41,397	161	133
1918	7	836.74	17,297	199	199
1919	8	164.81	3,407	22	25
1920	4	68.40	1,414	7	8
1911-20	104	30,726.87	635,181	2,677	1,681
1921	4	86.11	1,780	8	8
1922	11	170.71	3,529	14	14
1923	8	192.82	3,986	18	15
1924	8	191.42	3,957	29	19
1925	9	146.63	3,031	13	9
1926	7	105.70	2,185	9	5
1927	8	142.32	2,942	11	6
1928	10	296.35	6,126	23	14
1929	7	169.41	3,502	17	9
1930	8	144.16	2,980	14	5
1921-30	80	1,645.63	34,018	156	104
1931	18	170.77	3,530	18	5
1932	30	364.84	7,542	39	11
1933	26	395.95	10,120	43	15
1934	146	693.62	24,242	79	51
1935	85	625.57	21,895	85	61
1936	57	697.60	24,416	71	55
1937	75	1,036.00	36,260	79	61
1931-37	437	3,984.35	128,005	414	259
Total	1/ 20	56,964.04	1,223,181	5,758	3,494

1/ Approximate yearly average.

During the same period (1901-37), Gerry's figures show that the lode mines of Lemhi County produced $2,327,964 in gold, $2,416,903 in silver, $1,081,945 in copper, and $8,389,650 in lead. The total metal production of the county from 1901 to 1937 was $15,444,975.

TOPOGRAPHY

Eastern Lemhi County is traversed from its southern boundary almost to its northern boundary by the Salmon River. At North Fork the river turns abruptly west and crosses the county from east to west. At Salmon City the Salmon River is joined by the Lemhi River, which traverses southeastern Lemhi County above this point. Above Salmon City both rivers occupy comparatively wide valleys; the valley of the Lemhi and part of the valley of the Salmon are wide enough for large areas of rich farm and grazing land. Below Salmon City the valley of the Salmon is narrower and deeper. Between Salmon and North Fork and to a lesser degree between North Fork and Shoup there are numerous "bars" large enough to support prosperous farms. Below Shoup the river enters a narrow box canyon.

East of the Salmon Valley the Bitterroot Range rises steeply to 8,000 to 9,000 feet or more. The summit of this range forms the Continental Divide.

All of Lemhi County west and north of the Salmon River Valley is part of the great central Idaho uplift. This region is a dissected peneplain whose original surface, now represented by the highest ridges, was 8,000 to 8,500 feet above sea level. The Salmon River has cut a trough across this old peneplain to a depth of 4,000 to 4,500 feet below the original surface. The larger tributaries of the Salmon have eroded their lower courses almost as deeply and are gradually extending their canyons headward. Between these deep canyons lie large upland areas containing the smaller streams and the upper parts of the large streams. The upland areas are characterized by rounded, forest-covered hills and broad U-shaped valleys, the largest of which have been eroded down to about 6,000 feet above sea level. From the margins of these upland areas the streams plunge steeply down into the deep canyons of the Salmon and its large tributaries.

Lemhi County may thus be said to be divided into three distinct topographic provinces. One is the Salmon-Lemhi valley region, which contains the farms and larger settlements. Another is the precipitous western slope of the Bitterroot Range. The third and largest is the forested upland region covering all of the county west of the Salmon River and large areas between the Salmon and Lemhi Rivers.

CLIMATE AND VEGETATION

The lower parts of the Salmon River Valley in Lemhi County are characterized by hot summers and moderate winters. Precipitation is light and vegetation sparse. Most agricultural land along the Salmon or Lemhi River must be irrigated. For this purpose there is usually an adequate supply of water from the numerous permanent streams that flow down from the upland areas. Precipitation is increasingly heavy at higher altitudes. Nevertheless, vegetation is sparse along the Salmon-Lemhi Valleys wherever the Miocene lake beds occur (see section on General Geology). These beds, which are but lightly consolidated and, therefore, porous, are 5 to 15 miles wide and fill the Salmon-Lemhi Valley to depths of 2,000 feet or more from North Fork to the southern boundary of the county. Their surface is generally barren and sandy, except in stream bottoms or where irrigated.

Above the lake beds and in all of the upland areas the county is heavily forested. These forests are all included in the Salmon or Lemhi National Forests. Ponderosa (yellow) pine grows abundantly in favored locations below 5,000 or 5,500 feet altitude. Douglas fir, Engelman's spruce, and lodgepole pine grow in all parts of the upland area, except on the highest peaks or on the most precipitous slopes.

Good saw lumber may be obtained from the stands of yellow pine, which are supporting several commercial sawmills in the region. Mine timber, rough lumber, logs for building purposes, and firewood may be obtained from the stands of fir, spruce, or lodgepole in nearly all of the mining districts.

The climate in the upland areas is cold in winter and cool in summer. Frost or light snow may occur in any month of the year. The winter snows begin to pile up in November and remain on the ground until June or July, depending on the altitude.

Weather statistics for this section of Idaho are meager. The following tables, however, give some idea of general climatic conditions in the Salmon and Lemhi Valleys.

Precipitation at Lemhi, Lemhi County, Idaho[1]
(Elevation, 5,200 feet)

Month	Inches of precipitation[2]	Month	Inches of precipitation[2]
January........	0.56	July..........	0.75
February.......	.50	August........	.77
March..........	.74	September.....	.80
April..........	1.19	October.......	.60
May............	1.50	November......	.41
June...........	1.29	December......	.83
Total..			9.94

Frost data, Lemhi, Lemhi County, Idaho[1] [3]

Average date of last killing frost in pring..............	June 8
Average date of first killing frost in Fall................	September 15
Latest date of killing frost in Spring....................	July 2
Earliest date of killing frost in Fall....................	August 20

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[1] Official records, United States Weather Bureau.

[2] Average of intermittent observations from 1893 to 1926, inclusive.

[3] Average of 8 years observations.

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The town of Lemhi is about 34 miles by road south of Salmon.

The following table of snow-stake readings in the higher mountains was supplied by the United States Forest Service. These records, which are the average of several years' observations, indicate the depth of snow actually on the ground on Williams Creek Summit, one of the higher ridges in the Salmon National Forest, and on Moose Creek; both courses are between 7,000 and 8,000 feet above sea level. The Williams Creek Summit course comprises 30 stations and is situated on the ridge between the head of Williams Creek and the head of Moccasin Creek. The Moose Creek course comprises 18 stations and is situated along Little Moose Creek close to United States Highway 93 just south of the Montana-Idaho State line.

Station	Month	Inches	
		Snow depth	Water content
Williams Creek Summit....	February	36.2	10.6
Moose Creek..............	do.	37.6	11.2
Williams Creek Summit....	March	52.6	14.56
Moose Creek..............	do.	45.3	14.22
Williams Creek Summit....	April	31.75	12.3
Moose Creek..............	do.	25.22	9.86

TRANSPORTATION

Until recently, Lemhi County has been one of the least accessible parts of Idaho. Although the Salmon-Lemhi Valley provided the route for a water-grade all-year highway, it could be reached from outside points only over high mountain passes or through narrow river gorges. Consequently, the main routes of general travel passed around the county, and road construction within the county lagged behind most other sections of the northwest. Even today there are only a few miles of paved highway in the county.

The adoption as United States Highway 93 of the scenic route from Missoula, Mont., south through Salmon to southern Idaho has led to improvement of this road. It is now graveled throughout and gradually is being widened and straightened. Undoubtedly it will be paved in the near future.

A Forest Service dirt road is under construction by C.C.C. labor down the Salmon River toward Riggins, Idaho. When completed, this road will provide year-round water-grade communication with western Idaho. It is now completed on the eastern end to below the mouth of the Middle Fork of the Salmon. The western end has been built nearly half way from Riggins to the mouth of the South Fork of the Salmon, leaving close to 100 miles of construction before connection is made between the two sections. It is reported that an effort is being made to push this work to completion within a few years.

Until recently, very few parts of Lemhi County outside of the river valleys were accessible to automobile travel. The mountain regions could be reached by wagon road or pack trail only. This condition has been improved very greatly by the road-building program undertaken by the United States Forest Service in the last 6 years.

A good dirt road has been built over the mountain from Highway 93 about 6 miles south of Salmon to Leacock's Ranch and Forney, with connections to Leesburg, Meyer's Cove, Yellowjacket, and Challis. This road also connects at Leacock's Ranch with a dirt road down Panther Creek to the Salmon River road below Shoup.

North of the Salmon is a good, though in part very steep, dirt road, which runs from the Salmon River road up Spring Creek and thence across the mountains to Alta and Conner, Mont. Another similar road goes up Dahlonega Creek from Gibbonsville and thence across the Bitterroots to Wisdom, Mont.

These dirt roads are all maintained in good condition for automobile travel during the summer and fall but are closed entirely during the winter and early spring. They are usually closed from some time in November to some time in May or June, depending on the altitude. However, during the closed season, mail and supplies are carried to mountain settlements, such as Leesburg and Forney, by horse-drawn sleds.

In addition to the main routes of travel described above, there are a number of "truck trails" branching out to Forest Service lookouts and a few mines in the mountain districts. Some of these branch roads, especially those to Forest Service lookouts, are fairly good in dry summer weather; others are very rough at all times.

The following table gives the road distances, in miles, between the more important settlements in the placer-mining areas of Lemhi County.

Town or settlement	Approximate altitude	Forney	Gibbonsville	Leacocks	Leesburg	Mullan Camp	North Fork	Porter Camp	Salmon	Shoup	Yellowjacket
Forney............	5,700	-	-	12.5	22	-	-	-	42.5	40	15.5
Gibbonsville......	4,500	-	-	-	-	-	12	-	34	30.5	-
Leacocks..........	5,000	12.5	-	-	9	-	-	-	2/ 30	27.5	28
Leesburg..........	6,700	22	-	9	-	1/ 36	-	4	2/ 33.5	3/ 40	37.5
Mullan Camp.......	6,600	-	-	-	1/ 36	-	-	4/ 40	1/ 42.5	-	-
North Fork........	3,600	-	12	-	-	-	-	-	22	18.5	-
Porter Camp.......	7,100	-	-	-	4	4/ 40	-	-	37.5	-	-
Salmon............	4,000	42.5	34	30	2/ 33.5	1/ 42.5	22	37.5	-	40.5	58
Shoup.............	3,400	40	30.5	27.5	40	-	18.5	-	40.5	-	55.5
Yellowjacket......	5,900	15.5	-	28	37.5	-	-	-	58	55.5	-

1/ Via Williams Creek Summit (altitude 7,750).

2/ Via Williams Creek Summit. Via Jessie Creek-Sharkey Creek wagon road this distance is approximately 15 miles; this road crosses an 8,500-foot summit.

3/ Via Panther Creek.

4/ Via Williams Creek Summit and Leesburg. By trail up Moose Creek this distance is 4 to 5 miles.

A good system of pack trails extends to most parts of the region not accessible by road.

Railroad transportation into the county is afforded by the Gilmore & Pittsburg R.R. which runs from Salmon, Idaho, via Leadore, on the Lemhi River, to Armstead, Mont.

POWER

At present there are no commercial power developments in the vicinity of any of the Lemhi County placer fields; operators must generate their own power on the ground. Although water power might be developed at a few places and wood is nearly always available for small or temporary power plants, most placer operators use gasoline or Diesel power. The following retail prices for standard grades of gasoline or fuel oil were quoted by courtesy of the Standard Oil Co. in December 1938:

Cents per gallon, f.o.b.	Salmon	Shoup	Leesburg	Yellowjacket
Gasoline..............	22-1/2	23-1/2	22-1/2	23-1/2
Diesel oil.............	13	14	13	14

Gasoline not used on road transport is subject to a State tax rebate of 5 cents per gallon.

LABOR

Inasmuch as mining has always been one of the chief industries of Lemhi County, a supply of skilled and semiskilled mining labor adequate to meet the small needs of the community is nearly always available. However, the relative isolation of the district and the fact that most mine labor is of the prospecto miner-farmer class have resulted in a lower wage scale than is paid in the larger mining centers. In 1938 the few placer mines in operation were paying \$3.50 per day; lode mines were paying \$0.50 to \$1.00 per day more. If at any time the demand for mine labor should outgrow the local supply, the adjoining mining fields of Montana could be tapped.

GENERAL GEOLOGY

The only comprehensive report on the geology of Lemhi County was written by Umpleby[8]. Most of the following description of the general geology of the region has been abstracted from his report.

The oldest and most widely distributed formation is a thick series of Algonkian sedimentaries, chiefly quartzite, schists and slates, which cover most of northern Lemhi County and a large part of southern Lemhi County west of Leadore and Gilmore. These rocks have been extensively folded, sheared, and jointed.

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[8] Umpleby, Joseph E., work cited in footnote 7 (p.7).

Comparatively narrow bands of Paleozoic quartzites, dolomites, and limestones are exposed along the western slopes of the Bitterroot Range from Lemhi south to Nicholia and along the eastern slopes of the Lemhi Range south of Leadore.

At about the close of the Mesozoic era or the beginning of the Tertiary (late Cretaceous or early Eocene periods), the Algonkian and Paleozoic rocks were intruded by the granitic mass of central Idaho, one of the larger batholiths of the North American continent.

The granites are chiefly exposed in the northern part of the County. The largest exposures are northwest of Leesburg. There are some small exposures, however, near Yellowjacket and at the head of Boyle Creek. The intrusion of this granitic mass probably resulted in a considerable uplift of the overlying rock. During Eocene times the uplifted surface was eroded to a peneplain, or a surface of very low relief, with the accompanying deposition of large volumes of sediments in Montana east of the present Bitterroot Range.

After the area had been eroded well toward the base level of erosion it was again uplifted to about 8,500 feet above sea level and a new cycle of erosion began. A deep, broad valley draining south into the Snake River was eroded to a depth of about 5,000 feet along the present course of the Salmon-Lemhi Rivers south of North Fork, and another similar valley was eroded along the present course of the Pahsimeroi River. During Miocene times 2,000 feet or more of lake beds were deposited in these valleys from erosion of the adjoining uplands. Smaller lake deposits also were formed elsewhere in the region, notably along Moose Creek below the mouth of Daly Creek.

During Miocene times lavas were poured out, and at the close of this period thick beds of tuff were formed. At present these Miocene volcanics are exposed most extensively in the area lying between Forney and the Custer County boundary, extending eastward to the Lemhi River.

During the period of Miocene erosion described above it is evident that a relatively mature topography was developed on those parts of the uplifted land mass lying above the surface of the Miocene lakes. At one time this surface must have been at least 6,000 feet above sea level, as indicated by the present boundaries of the lake deposits. The lowest parts of the broad upland valleys are also about 6,000 feet above sea level, indicating that the base level of erosion stood at this elevation for a considerable period.

Following deposition of the Miocene lake beds, the drainage was diverted north and west into the present course of the Salmon River, the lakes were drained, and the river immediately started eroding the lake beds. Erosion of the upland areas was rejuvenated, and the larger streams started cutting deep canyons headward from the new base level of erosion established by the Salmon River.

During the Pleistocene epoch, glaciers capped the higher mountains and occupied the valleys down to elevations of 7,000 and occasionally 6,000 feet above sea level.

Ore deposits in Lemhi County were formed in at least two distinct periods. The first and most important period of ore deposition was in late Cretaceous or early Eocene times during, or shortly after, the period of batholithic intrusion. The other period of ore deposition was in the late Miocene or early Pliocene period. Mineralization in this latter period was comparatively weak, however, and is found only in the southwestern part of the county in the Parker Mountain, Gravel Range, and, possibly, Musgrove districts.

Numerous gold-bearing veins are closely associated with the granite phases of the batholith and are widely distributed throughout the northern part of the county.

There are very few exposures of intrusive rocks in southeastern Lemhi County; the few that are present belong to the quartz-diorite phase. Metallization in this area is predominantly lead-silver with little or no gold.

Between the gold deposits of northern Lemhi County and the lead-silver deposits of southeastern Lemhi County is a band of copper mineralization extending east and west across the center of the county. This distribution suggests a broad zonal arrangement around and above the batholith.

The gold placer deposits were formed by the erosion and concentration of the gold-bearing veins.

GENERAL DISCUSSION OF PLACER DEPOSITS

As pointed out above, the gold-bearing veins appear chiefly in the northern part of the county either closely associated with granite outcrops or, presumably, a relatively short distance above the granite intrusives.

Granite exposures are comparatively small in proportion to the total area; it may be assumed, therefore, that erosion, except along the deepest canyons, has exposed only the highest parts of the batholith. Inasmuch as some granite is exposed along the highest ridges, it is probable that some gold veins were removed during the Eocene erosion cycle. Most granite exposures and the associated gold veins, however, are lower than the 8,500-foo summits that Umpleby believed constituted the surface of the Eocene peneplai Consequently, most of the erosion of these veins must have taken place since Eocene times. Undoubtedly, much fine gold was carried down and disseminated through the Miocene lake beds, which are known to contain small amounts of gold in places. Old gold-bearing channels may have been covered by these beds. The most favorable areas for the accumulation of large placer deposi were the bottoms of the mature valleys formed during the period of the Mioce lakes. As already pointed out under the section on general geology, these valley bottoms usually were nearly 6,000 feet above sea level. The rejuvenated erosion between this level and the present base level is progressi too rapidly to permit the formation of extensive placers. Some fairly large placers have accumulated, however, in the present valleys of the Salmon and the lower parts of its larger tributaries.

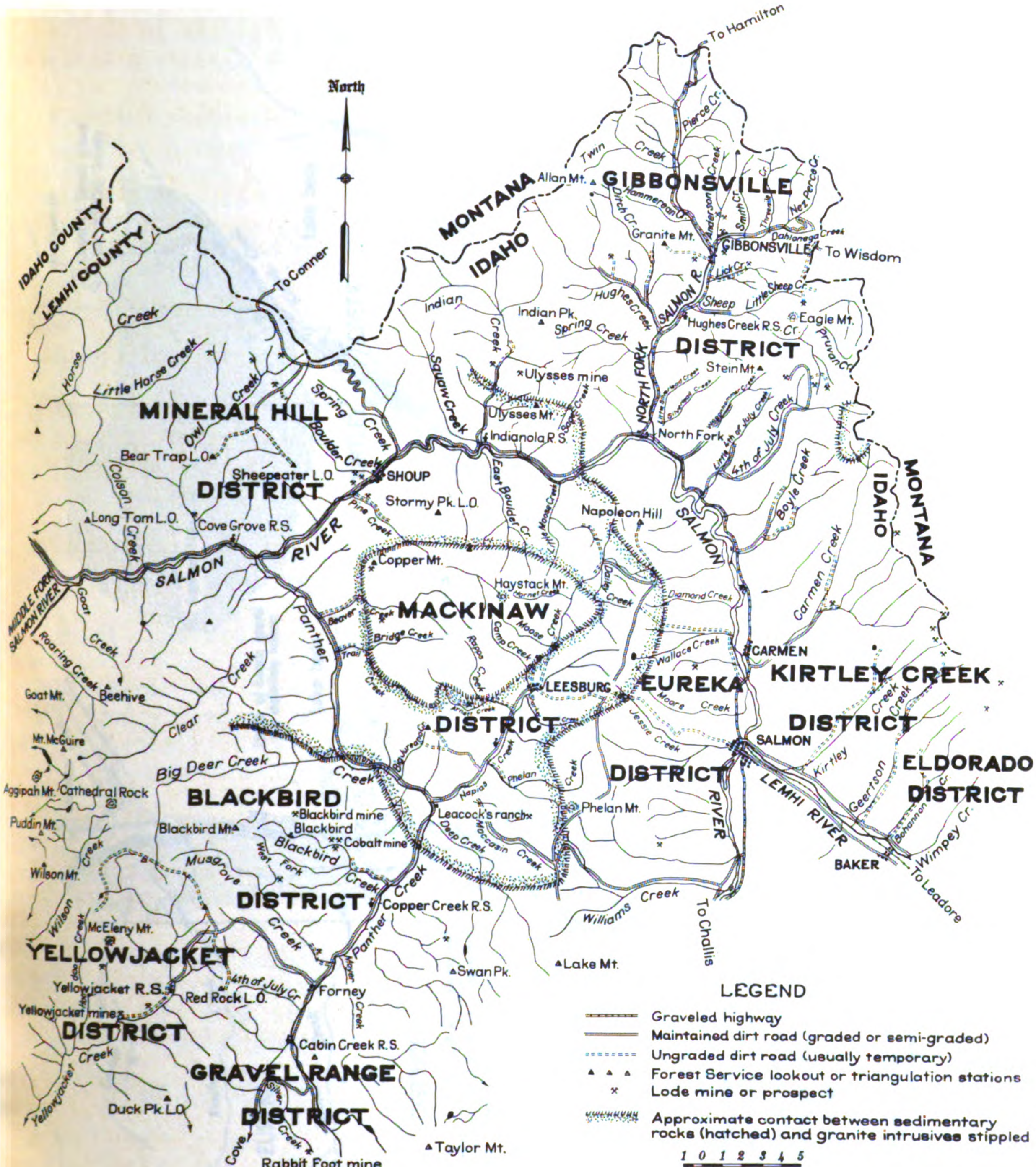

Figure 2.–General map of placer-mining districts of Lemhi County, Idaho.

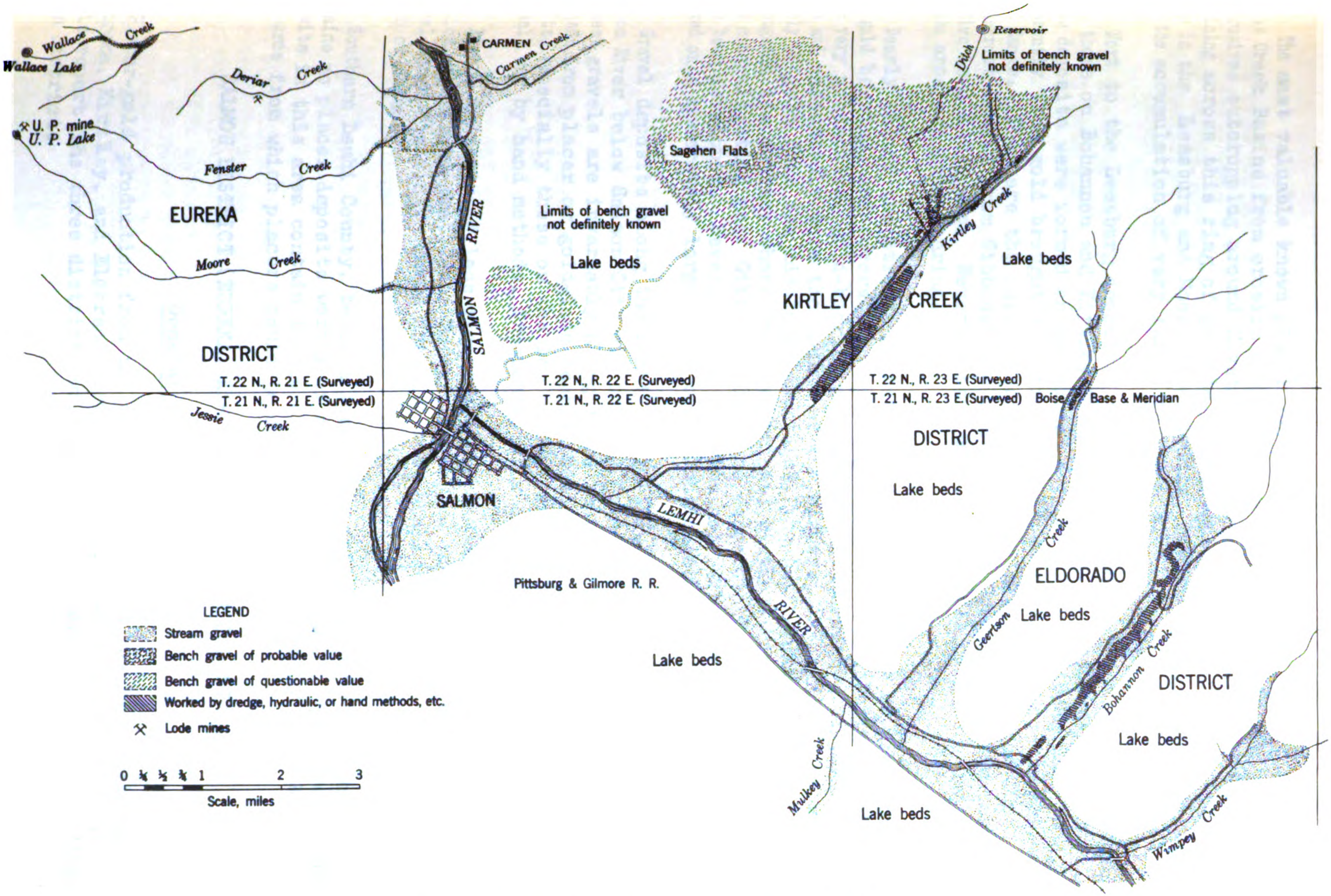

Figure 3.—Gravel deposits of the Eureka, Kirtley, and Eldorado districts, Lemhi County, Idaho.

The most valuable known placer deposits were formed in the Leesburg and Moose Creek Basins from erosion of gold veins associated with the granite intrusives outcropping around Haystack Mountain (see fig. 2). Most streams draining across this ring of granite contain gold placers of some value. Only in the Leesburg and Moose Creek Basins, however, were conditions suitable for the accumulation of very large, rich deposits.

Next to the Leesburg deposits, the most productive placers in the county were those on Bohannon and Kirtley Creeks a few miles southeast of Salmon. These deposits were formed on the eroded surface of the Miocene lake beds, apparently from gold brought down from vein deposits high up on the Bitterroot Range. They are the only deposits along the western slope of the Bitterroot Range, from Gibbonsville south to Pratt Creek, that have been productive in a large way. Nevertheless most, if not all, of the other streams in the area are gold bearing.

Nearly all of the streams draining into the North Fork of the Salmon are gold bearing, and several, notably Hughes Creek and Dahlonega Creek, have been very productive; gold-bearing veins are widely distributed through this area and undoubtedly were the source of the placers. As a result of this supply of gold from the adjoining mountains, the North Fork is gold bearing throughout its course; where locally enriched by the strong center of gold lode mineralization near Gibbonsville, some commercially valuable placers have been developed. Several bench deposits near Gibbonsville have been worked on a moderately large scale by hydraulic methods.

Gravel deposits along the Lemhi River below Pratt Creek and along the Salmon River below Salmon City all contain gold in varying quantities; the richest gravels are invariably along those sections of the river fed by streams from placer or gold-lode bearing districts. Many of the river deposits, especially those on the low benches of the Salmon, have been worked in a small way by hand methods, frequently with considerable success.

Placer deposits of less importance are associated with gold lode mineralization at Yellowjacket, near Forney, and below the Rabbitfoot mine in the Gravel Range district. There are also some small placers in the mountains north of Shoup.

Southern Lemhi County, below a line drawn from Meyers Cove to Baker, contains no placer deposits worthy of mention. As already pointed out, lode deposits in this area contain little or no gold, consequently there has been no source from which placers could be derived.

SALMON DISTRICT (EUREKA, KIRTLEY, AND ELDORADO DISTRICTS)

General Discussion

Placer-gold production from the vicinity of Salmon has been entirely from the Eureka, Kirtley, and Eldorado districts (figs. 2 and 3). For convenience, in this report the three districts will be grouped under the general heading Salmon district.

The Eureka district lies between the Salmon River on the east and the Salmon River Mountains on the west. It extends from Williams Creek northward for about 10 miles and includes Wallace Creek, Moore Creek, Deriar Creek, Jessie Creek, and Fenster Creek. All of these creaks have produced some placer gold; none, however, have been important producers to date.

The Kirtley Creek district coincides in a general way with the Kirtley Creek drainage area. It has been the most productive placer area in the Salmon district.

The Eldorado district includes the drainage basins of Geertson, Bohannon, and Wimpey Creeks. The copper mines southwest of Baker are also usually included in the Eldorado district. Bohannon Creek has been the chief producer of placer gold in this district; a small production has also been obtained from Geertson Creek.

Bureau of Mines records show that from 1911 to 1918, inclusive, Kirtley Creek produced 24,145 ounces of gold and 2,038 ounces of silver from placer operations. From 1901 to 1917, inclusive, Bohannon Creek placers produced 15,317 ounces of gold and 2,769 ounces of silver. Geertson Creek placers produced 237 ounces of gold from 1901 to 1905, inclusive. Hence, the three creek produced 39,699 ounces of gold and 4,807 ounces of silver from placer operations between 1901 and 1918. These records do not include the Kirtley Creek hydraulic operations nor any operations prior to 1901. It is therefore fairl safe to say that the Salmon district has produced a million dollars in placer gold. Three-fourths of the total placer production of Lemhi County since 1901 has been obtained from this region.

The placer deposits of the Kirtley and Eldorado districts rest on the surface of the partly eroded Miocene lake beds and consequently have been deposited since the lakes were drained. The lake beds are but lightly consolidated and are being eroded at a rapid rate. Evidently the creek channels change frequently and very quickly cut new trenches below the former channel. This process has left a succession of low benches, which usually are clearly defined near the lower end of the streams but tend to merge imperceptibly into one another farther upstream. In many cases the present creek channel has cut a trench 15 to 20 feet below the last gravel deposit. All the low benches and present stream channels have been mapped and described as stream gravels.

Large volumes of unworked gold-bearing gravel remain on Kirtley, Geertso and Bohannon Creeks and along Lemhi River opposite the mouths of these creeks Although these deposits apparently could not be mined at a profit under the old price for gold, parts of them may be found to be workable with gold at $35 per ounce. Hydraulic mining, which has been started recently on Wallace Creek in the Eureka district, may lead to development of other deposits on streams rising in the mineralized areas west of the Salmon River. There are also some high gravels along old creek channels west of Kirtley Creek that may have commercial possibilities.

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Stream Gravels of the Salmon District

Lemhi River

The Lemhi River bottom (fig. 3) ranges in width from 3,000 up to 6,000 feet. An area of gold-bearing gravels of probable commercial or near-commercial grade occurs along the north side of the river bottom near its confluence with Kirtley, Geertson, and Bohannon Creeks. A limited amount of testing that was done along this section of the river is said to have indicated that the gravel is about 8 yards deep and mixed with considerable clay.

Gold values are variously reported at 9 to 12 cents a yard at the present price of $35 an ounce for gold. The amount of testing done, however, was insufficient to determine the probable yardage available. It is said that the drillers were discouraged by the clay in the gravel. It is generally thought that there is little or no gold above Bohannon Creek. All of the Lemhi River bottom in this vicinity is held as patented agricultural land.

Kirtley Creek

Kirtley Creek flows into the Lemhi River from the north about a mile above the town of Salmon. Stream gravels extend along the creek from its confluence with the Lemhi River to within a few miles of its source, a distance of about 7 miles. The deposits along the lower end of the creek, where it flows across the Lemhi River flats, might more properly be considered a part of the Lemhi River deposits. From the edge of the Lemhi Valley, about 1-1/4 miles north of the Lemhi River and extending upstream for about 3 miles, the stream-gravel deposits of Kirtley Creek range in width from 2,000 to 3,000 feet. The next 2-1/2 miles upstream are much narrower, ranging in width from 150 to about 300 feet.

About 2-1/4 miles of the creek bottom has been dredged to a width of 700 to 1,000 feet. The dredging was entirely on the west side of the creek. From the course that was followed, it might be inferred that the commercial gold values followed a definite channel. The ground was worked from 1910 to 1918 by a dredge that was equipped with 8-cubic-foot buckets. According to statements of men who worked on the dredge, the gravel was about 14 feet deep. Calculations based on production figures and rough yardage estimates indicate a recovery of 8 to 10 cents a cubic yard with gold at $20 per ounce. Bedrock consists of clay, a part of the Miocene lake beds that cover the entire area.

Probably more than half of the creek gravels indicated on the map (fig. 3) remain undredged. There are few or no data available upon which to base an estimate of the value of these gravels for dredging purposes at the present price of gold, but undoubtedly it was too low-grade to be worked with gold at $20 per ounce.

All of the land at the lower end of the creek for 2-1/2 miles north of the Lemhi River is patented and is being used for farming. Most of the land at the upper end of the creek is also patented, partly as agricultural and partly as mining claims.

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Geertson Creek

Geertson Creek enters the Lemhi River from the northeast about 7 miles above the town of Salmon. The gradient is about 160 feet in a mile. The flow in July 1938 was estimated at 12 to 16 cubic feet per second. Some water, however, was being used for irrigation, and the estimate may not be accurate.

Stream gravels extend from the mouth of the creek for about 6-1/4 miles upstream. They are continuous except for about 500 feet near the upper end, where the stream flows through a narrow cut in the lake beds. Near the lower end the maximum width is around 1,500 feet. This gradually decreases to about 400 feet near the upper end of the creek.

About 1/2 mile of old hydraulic workings near the upper end of the creek is the only indication of any placer mining ever having been done anywhere along the stream. Much of the ground was tested for dredging in 1917. The present owners of the ground say that 10 lines of holes, a total of 170, averaged 22 feet deep and 10 cents per cubic yard with gold at $20 per ounce. In 1938 plans were being made to again drill this ground.

There is no evidence that any work ever was done on the high bench gravels along Geertson Creek.

Bohannon Creek

Bohannon Creek flows into the Lemhi River from the north about 1-1/2 miles east of Kirtley Creek. The gradient is about 150 feet in a mile. It was impracticable to estimate the available water in the creek, as a large part of the flow was being used for irrigation at the time of the field examination in June 1938. However, the total discharge during that period, including the amount of water in irrigation ditches probably exceeded 25 cubic feet per second.

Gravel deposits extend upstream for about 5 miles from the confluence wit Lemhi River. They range in width from 2,000 feet to nearly a mile. Old channels are indicated more plainly by surface conditions than at either Kirtley or Geertson Creeks. Three channels, which for convenience may be designated as present, recent, and ancient, can be traced from the lower end of the creek for about 2 miles upstream. Above this they are less noticeable but may be traced by old hydraulic and dredge workings. The present channel, which is occupied by Bohannon Creek, is on the east side of the valley and is 150 to 250 feet wide. The recent channel, adjacent to the west side of the present one, is 400 to 700 feet wide. The ancient channel on the west side of the valley probably has a maximum width of 1,000 feet.

Relative elevations of the three channels at different points along the valley indicate a much steeper gradient for the recent channel than for the present or ancient ones.

Of the three channels, only the recent has been a producer of placer gold At the lower end it was worked by ground-sluicing methods for a little more than 1/4 mile. Just above this it was hydraulicked for about 2-1/4 miles, and from the upper end of the hydraulic workings it was dredged for a little more than 1/2 mile.

Where the gravel was worked by hydraulicking it had a depth of 15 to nearly 30 feet, with 2 to 4 feet of top-soil overburden. Boulders 1 foot or more in diameter constitute only 1 to 2 percent of the aggregate, except at the upper end where the percentage is greater. Relatively few of the boulders had to be piled, most of them having been small enough to be sluiced to the tailings piles on the creek bottom.

Irregularities of the dredged area as well as of the hydraulic workings indicate attempts to work the ancient channel to the west. At several places along the west edge of the hydraulic pits, where two definite channels can be distinguished by benches, cuts had been made into the west channel, presumably for testing purposes. From the limited amount of material removed from these cuts it is apparent that the amount of gold was discouraging. A number of test shafts to the northwest of the road (fig. 3) also indicate this, as they are in ground that could have been mined by the same set-up that was used in mining the ground to the southeast of the road. About 25 percent of the dredging seems to have been on the ancient or west channel. The shape of the dredged area, however, indicates that recovery dropped when the dredge got into the ancient channel.

There seems to be little doubt that most of the unworked ground on the northwest side of Bohannon Creek contained gold but that it was too low-grade to be worked with gold at $20 per ounce. With gold at $35 per ounce, some of this ground might be commercial. One of the explanations for the present lack of mining activity on Bohannon Creek, as well as on Kirtley Creek, is that there is a conflict between mining and agricultural interests concerning water rights and stream pollution.

The ground along the lower end of the creek was patented and is being used as agricultural land. Most of the rest has been patented as mining claims belonging to Gustave Pabst of Milwaukee, Wis. Above the forks and on the east side of the main creek are several agricultural claims covering bench deposits. These, however, have little or no value as placer ground.

Wimpey Creek

Wimpey Creek flows into the Lemhi River about 2 miles east of Bohannon Creek. Gravel deposits along this creek consist almost entirely of bench deposits, shown on the map as stream gravels, 35 to 75 feet above the creek level. The nearly total lack of stream gravels at the level of the present stream channel is due no doubt to the steep creek gradient of about 200 feet in a mile. So far as known, no appreciable amount of placering was ever done anywhere along the creek. It is thought that the gravel generally is very low-grade. Inasmuch, however, as the source of the creek is in the same general area as that of Bohannon Creek, it is possible that richer gravel may be discovered.

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Pratt Creek, Sandy Creek, and Kinney Creek

Pratt Creek, Sandy Creek, and Kinney Creek (not shown on the map) flow into the Lemhi River southeast of Wimpey Creek. A small amount of gold has been produced on Pratt Creek, but Sandy Creek and Kinney Creek never have been placered nor is it recorded that placer gold ever was discovered in paying quantities. The amount of placer gold along the creeks to the south and southeast of Bohannon Creek seems to decrease gradually. For this reason there would seem to be less possibility of discovering placers along these streams than along Wimpey Creek.

Wallace Creek

Wallace Creek is a tributary of the Salmon River from the west. The two streams unite about 6 miles below Salmon. The first 4 miles of the joint stream has a gradient of about 500 feet in a mile. The only placer deposits along this section of the creek are near the lower end, where it flows into the Salmon River bottom. Here a very limited amount of placering has been done.

Beginning about 4 miles west of the river at an elevation of 6,200 feet and extending upstream for about a mile are gravel deposits ranging in width from 400 feet at the lower end to about 50 feet at the upper end. The creek gradient at the lower end of the deposits is about 150 feet in a mile and at the upper end about 250 feet in a mile.

The lower end of the deposit is 18 to 25 feet deep and consists of well-rounded granite material ranging in size from pebbles to boulders 2 feet in diameter. From 15 to 25 percent of the total consists of boulders 1 foot in diameter or larger. The upper end of the deposit is shallower, and the material is more angular.

In June 1938 the lower end of the deposit was tested by the Golden Dawn Mining Co. (J. W. Abbott of Boise, president) by sinking shafts to bedrock. Later on a pipe line and hydraulic equipment were installed and hydraulickin was started. It is stated that the testing indicated about 25 cents in gold per cubic yard. The property belongs to Adolph Magensen and is operated under lease.

Deposits along the tributary from the south (fig. 3) are similar to those on the main creek but are much smaller and shallower. The lower end of this tributary was worked earlier; it is on the property of Adolph Magens The upper end is held by location by L. C. Browning, who worked it on a sma scale in the summer of 1938. Parts of it proved to be very rich. Seventy-five yards of gravel from the east side of the pit yielded 4 ounces of gold or about $1.20 per yard. Bedrock consists of decomposed granite. A combination of hydraulic and ground-sluicing methods was used in mining.

Deriar Creek, Fenster Creek, and Moore Creek

Deriar Creek, Fenster Creek, and Moore Creek flow into the Salmon River from the west just south of the town of Salmon. They are similar to Wallace Creek in that the greater part of their course is in country too steep for the accumulation of placer deposits. Where they enter the Salmon River bottom the gradient is less steep and some gold-bearing gravels have accumulated. The lower ends of all three have been placered to a limited extent. The upper end of Moore Creek, like that of Wallace Creek, has a gradient of 150 to 250 feet in a mile. Conditions along this part of the creek seem to favor the formation of placers, although none of importance has been found.

Bench and High Gravels of the Salmon District

General Discussion

Between Kirtley and Carmen Creeks is a large plateaulike area of Miocene lake beds 500 to 1,500 feet above the Salmon River. Recent erosion channels have been diverted north and south to the present courses of Carmen and Kirtley Creeks, leaving this area as a high, partly dissected, barren plateau. There is abundant evidence, however, that at one time fairly large streams flowed over its surface and formed stream gravel deposits of considerable size. As some of these streams, especially those just northwest of the present course of Kirtley Creek, must have originated in the same area in which Kirtley Creek now rises, it is probable that some of their gravels are gold-bearing.

Sage Hen Flats

One such channel can be plainly traced into a basinlike area known as Sage Hen Flats (see fig. 3). The stream gravels in this area are said to contain gold, and there is evidence that considerable testing was done on them at one time. The writers were unable to obtain dependable information as to the outcome of these tests. In this vicinity there are also numerous other gravel deposits, some of which may contain paystreaks. The entire absence of water on the plateau undoubtedly has been a deterring factor in any attempt at placer mining. If, however, enough yardage of commercial gravel could be proved, it would seem possible to bring water from the reservoir at the head of Kirtley Creek. Large sections of the old ditch to the Kirtley Creek hydraulic workings are still in good repair and might be used.

Kirtley Creek Benches

Parts of several old channels a short distance west of Kirtley Creek remain as benches along the Kirtley Creek Valley. These benches were worked extensively at one time.

Water was brought from Carmen Creek to a reservoir near the divide between Carmen and Kirtley Creeks. From the reservoir the water was taken through a ditch about 2 miles long to the head of a flume, thence through the flume down the hill to a penstock, and thence through a pipe line to the hydraulic pits.

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The workings (fig 4) expose the gravel and the underlying lake beds for about 2,000 feet up and down the side of the hill. Four distinct stream channels are exposed; the lowest is about 150 feet above the present stream and the highest about 425 feet above. Erosion has tended to reduce the benches formed by successive channels to a common slope. Thus, in many places the old channels are covered by debris from those above and are difficult to find except by prospecting. In other places, however, the position of channels can be determined by slight irregularities in the slope of the hill or by outcrops of small areas of boulders.

It is evident that much of the lake-bed material was mined along with the gravel from the channels. Whether the lake beds contain gold in commercial quantities or whether they were mined because of insufficient understanding of geological conditions is not known. Inasmuch as they were derived from the same general sources as the gravel in the stream channels, they may contain some gold. It does not seem probable, however, that they were deposited under conditions favorable for the concentration of gold in commercial quantities. In other parts of the district where hydraulicking was practiced extensively only the stream channels were taken; the lake beds were left intact, except where it was necessary to remove them to expedite mining of the other material.

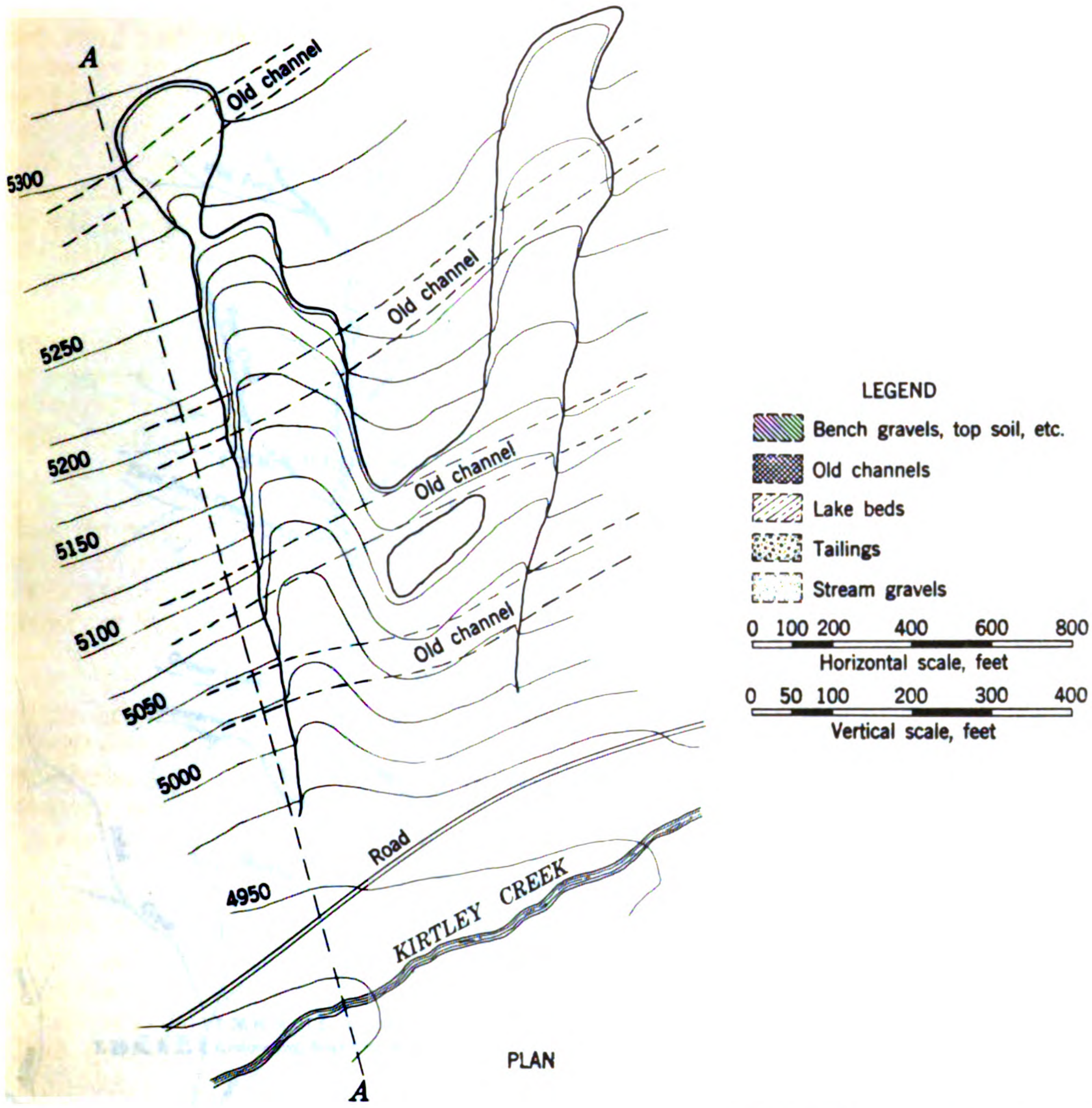
Pioneers who are familiar with the early operations have stated that the ground worked was rich. Hydraulicking is said to have been stopped because of conflict with agricultural interests. In June 1938 a small amount of selected material was run through a dry-washing machine by a prospector and his son. Although the percentage recovery was probably low, about 50 cents per yard was recovered from the material treated.

GIBBONSVILLE DISTRICT

General Discussion

In this paper the Gibbonsville district will be considered as including all the drainage basin of the North Fork of the Salmon. This is a logical subdivision, both geographically and geologically and logically might be called the North Fork district. Inasmuch as Gibbonsville is the largest settlement, the name of the town is generally applied to the entire district

Gravel deposits of the Gibbonsville district are found along the North Fork of the Salmon River and its larger tributaries. Although the district is widely mineralized with gold-bearing quartz veins, high-grade gulch deposits such as are found near Leesburg are notably lacking. The valleys of the smaller streams usually are too steep to permit the accumulation of placer deposits, and the larger streams flow through straight narrow valleys Consequently, the basinlike depressions most suitable for the accumulation of larger placer deposits generally are lacking. At the confluence of Dohlonega Creek with the North Fork, however, is a steep-walled basin, which aided by the proximity of numerous rich gold veins, has made the vicinity the center of placer mining in the Gibbonsville district.



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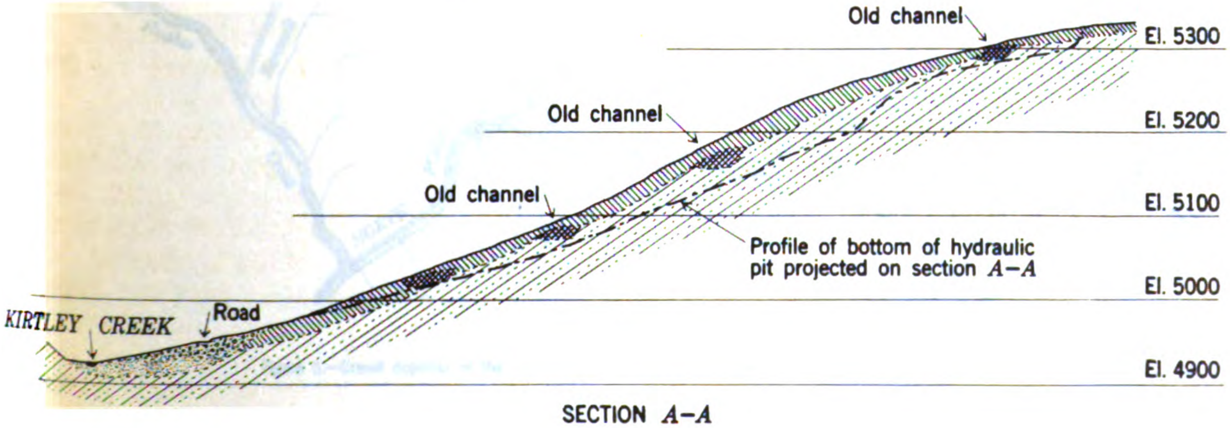

SECTION *A–A*

Figure 4.—Plan and section of hydraulic workings on upper Kirtley Creek.

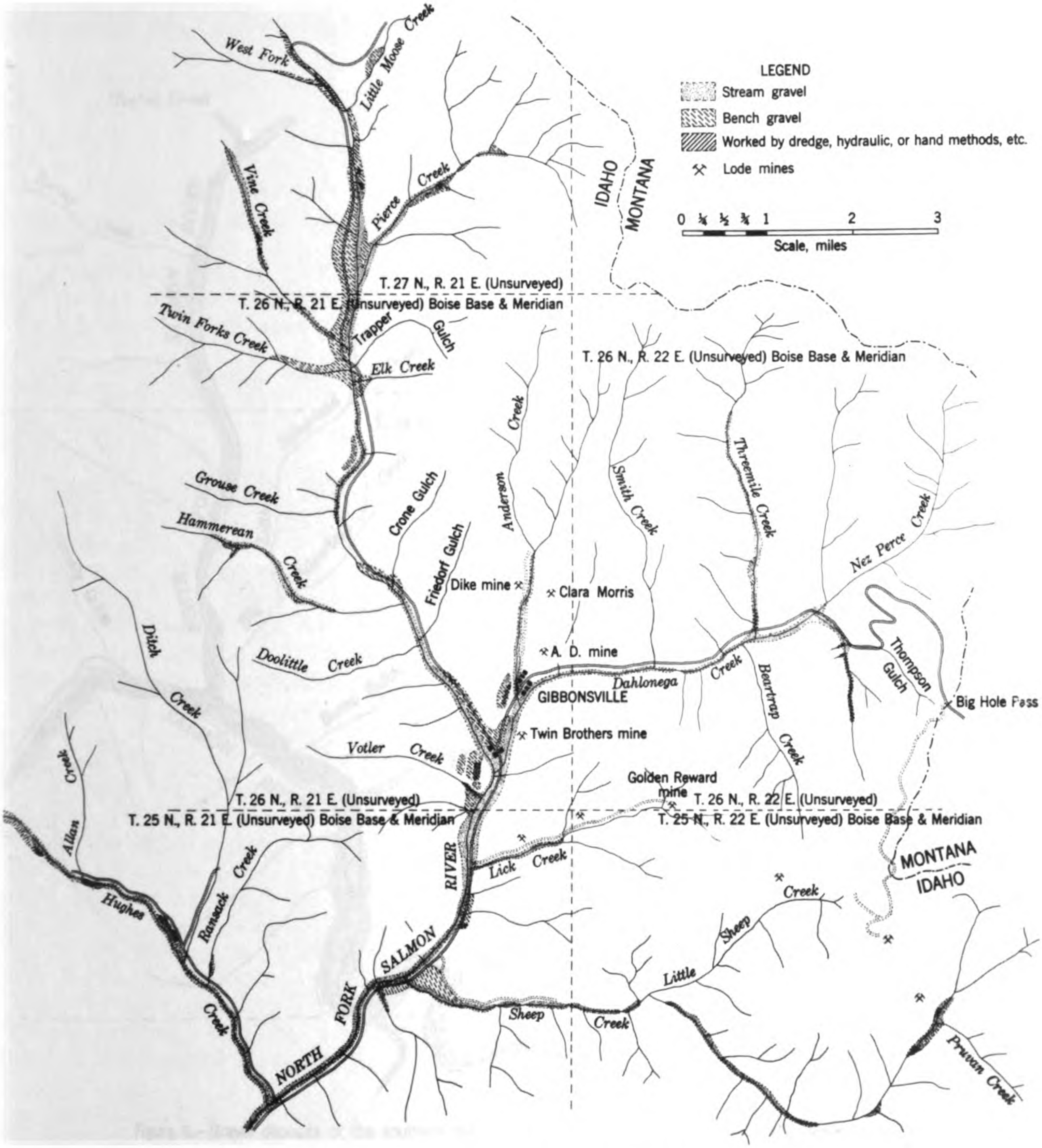

Figure 5.—Gravel deposits of the northern part of the Gibbonsville district, Lemhi County, Idaho.

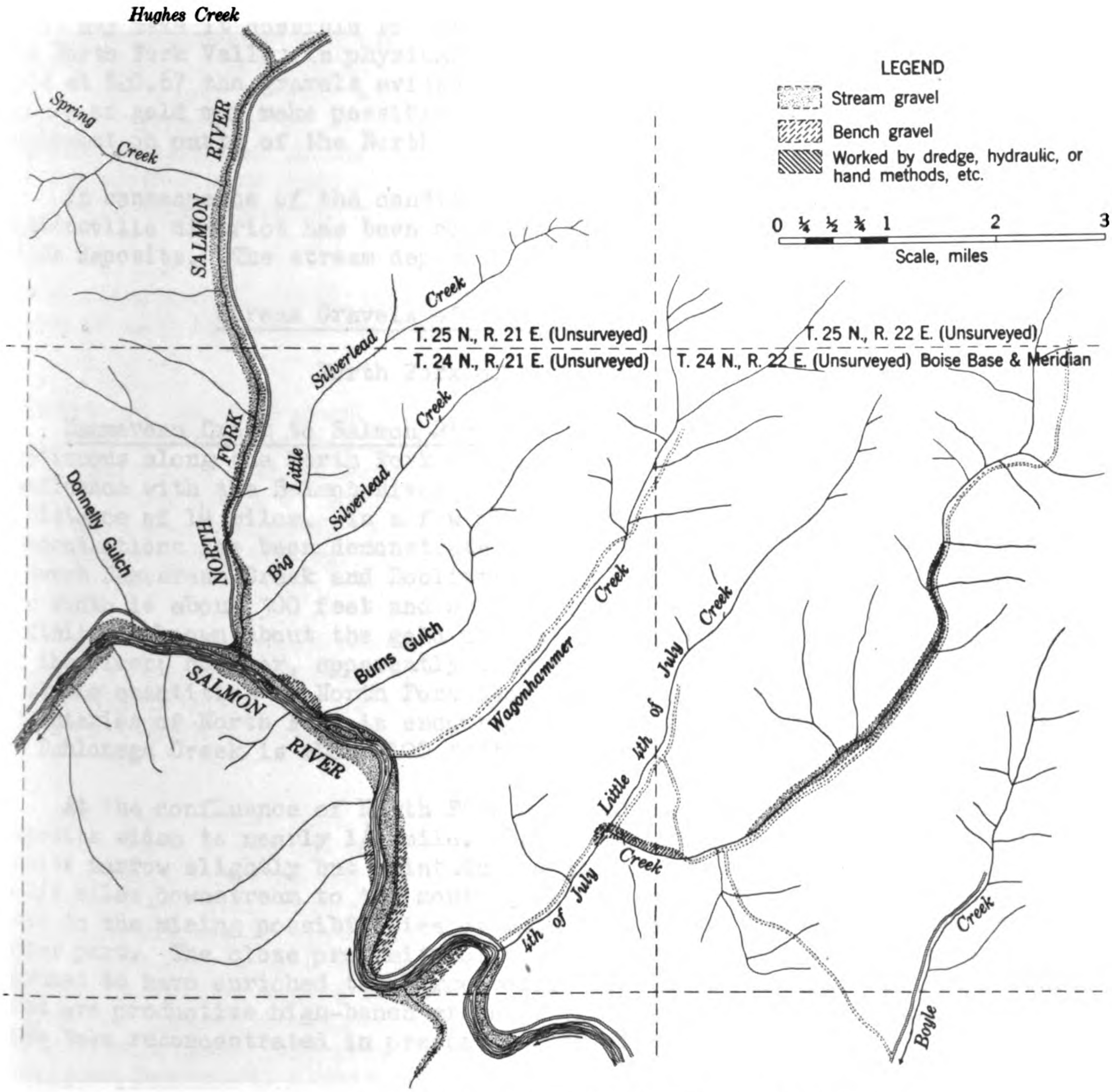

Figure 6.—Gravel deposits of the southern part of the Gibbonsville district, Lemhi County, Idaho.

Most of the larger streams of the district, because of their relatively flat gradients, also have permitted the accumulation of gravel deposits along their courses. These deposits are characteristically long, narrow, and relatively low-grade. They have been too low-grade for hand mining and too small or too flat for dredging or hydraulicking.

The recent development of equipment and technique of mining with draglines may make it possible to work many of these stream deposits at a profit. The North Fork Valley is physically fairly well suited to dredging, but with gold at $20.67 the gravels evidently were too low-grade to be worked. Higher prices of gold may make possible the use of bucket-line dredges or dragline equipment on parts of the North Fork Valley.

In consequence of the conditions described above, placer mining in the Gibbonsville district has been confined almost entirely to hydraulicking of bench deposits. The stream deposits are practically virgin.

Stream Gravels of the Gibbonsville District

North Fork of the Salmon River

Hammerean Creek to Salmon River. - Stream gravels of workable size are continuous along the North Fork of the Salmon River (figs. 5 and 6) from its confluence with the Salmon River to a short distance above Hammerean Creek, a distance of 14 miles. In a few places the presence of gold in commercial concentrations has been demonstrated. The gravels are 50 to 100 feet wide between Hammerean Creek and Doolittle Creek; a mile above Dahlonega Creek the width is about 300 feet and at Dahlonega Creek about 600 feet. Nothing definite is known about the gold content or depth of gravels along this part of the river; however, apparently they are deep. The presence of gold in workable quantities on North Fork above Hammerean Creek and on several tributaries of North Fork is encouraging. The gradient from Hammerean Creek to Dahlonega Creek is about 100 feet to the mile.

At the confluence of North Fork and Dahlonega Creek the stream-gravel deposits widen to nearly 1/4-mile. Below Dahlonega Creek the North Fork deposits narrow slightly but maintain a width of 600 to 900 feet for about 1-1/2 miles downstream to the mouth of Lick Creek. More attention has been paid to the mining possibilities of this part of the North Fork than to any other part. The close proximity of numerous productive gold lodes may be assumed to have enriched the large volume of gravels in this vicinity. There also are productive high-bench gravels, the eroded portions of which must have been reconcentrated in present stream channels.

In addition to the stream gravels and high-bench gravels, a large volume of low-bench gravels is present at the confluence of North Fork with Dahlonega Creek. These are shown in figure 5 as stream gravels. This bench is only a few feet higher than the stream gravels at the confluence but is about 30 feet higher a mile up North Fork. Nothing is known regarding its gold content, but it may be supposed to be gold bearing.

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It has been reported that 10 holes were drilled several years ago in the North Fork gravels near the mouth of Dahlonega Creek. It is said that these holes were 17 to 55 feet deep and that the gravel contained 17 to 40 cents per cubic yard with gold at $20 per ounce. Consequently, it seems likely that there are commercial or near-commercial gravels in this vicinity.

Below Lick Creek the stream gravels of the North Fork narrow considerably They are continuous for the remaining 10 miles to the main Salmon River. Throughout most of this distance the deposit is nearly 300 feet wide and in places 600 feet or more. In a few places, however, the canyon is so narrow that dredge operations would be impeded. Practially nothing is known about the depth or gold content of the gravels along this part of the river. Although it is to be expected that these gravels will be substantially leaner than those near Dahlonega Creek, the proved existence of valuable placer deposits on Hughes Creek and Sheep Creek encourages a hope that there may be a workable paystreak in North Fork to at least some distance south of the mouth of Hughes Creek (figs. 5 and 6).

It may be assumed that the gold content of the North Fork gravels becomes progressively lower from Hughes Creek to the Salmon River, but this is not an established fact.

From Dahlonega Creek to the main Salmon, the North Fork has an average gradient of about 70 feet to the mile. According to statistics of the Geological Survey[9], the discharge of the North Fork in the "water year" 1935-36 ranged from a low of 60 cubic feet per second in early April to a maximum of 1,720 cubic feet per second on June 15. No records were kept from December to March, inclusive. The mean discharge for the year was 222 cubic feet per second.

Virtually the entire North Fork Valley from Dahlonega Creek to the main Salmon is held as patented agricultural land (chiefly grazing), owned by a number of individuals. Past attempts to obtain satisfactory options on large acreages have been unsuccessful. However, this difficulty is not thought to be unsurmountable.

Above Hammerean Creek. - From Quartz Creek to Twin Forks Creek (fig. 5) the bottom of North Fork ranges in width from 75 to 150 feet. Much testing and some mining have been done along this part of the stream. About 3/4 mile below Twin Forks Creek a small ground-sluicing operation was being conducted during July and August 1938 by Bentley and Gregg of Gibbonsville on ground owned by them. The gravel at the workings is 6 to 8 feet deep. About 5 percent of the total volume consists of boulders 1 foot or more in diameter Gold is mostly on bedrock but is scattered to some extent through the whole mass. It is relatively coarse, ranging in size from very small particles to pieces as large as or larger than a pinhead. In places the gravel runs as high as 15 to 20 large colors to a pan. The creek gradient is steep enough for ground sluicing or hydraulicking.

From Twin Forks Creek to Pierce Creek the creek bottom is covered with a heavy growth of pine and spruce timber. Very little testing and no mining have ever been done along this part of the creek.

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[9] Surface Water Supply of the United States, Part 13, p. 201.

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Above Pierce Creek the stream gravels range in width from 150 to 350 feet. They are covered by a moderately heavy growth of willows and similar undergrowth, with some pine and spruce. A little more than 1/4 mile above the confluence of the creeks are indications of old placer operations. The work is very old, however, and it was impossible to make definite observation as to depth and character of gravel. The remaining part of the deposit would be suitable for a dragline operation, although the yardage is small. The ground is patented as agricultural land and is owned by Bart Achord of Gibbonsville.

Hammerean Creek

Hammerean Creek flows into North Fork from the west about 2 miles above Dahlonega Creek. The gradient is steep, ranging from 350 to 500 feet in a mile. In July 1938 the flow was 2 to 3 cubic feet per second.

The lower end of the creek, for about a mile, flows through a narrow canyon in which there are no gravel deposits. Extending upstream for a distance of about 1-3/4 miles from the upper end of this canyon the gravel deposits range in width from 75 to about 150 feet. There are bench deposits, also, but because of the steep creek gradient they may be confused with stream deposits. A bench that is 50 to 75 feet above the creek level at one place may be only a few feet above it only 1/4 mile farther upcreek.

In the summer of 1938, R. C. Medberry and Jim Robinson of Gibbonsville did a little work near the upper end of the deposit. A trench along the creek bottom about 60 feet long and several test pits 6 to 8 feet deep were excavated in an attempt to find bedrock. A 10-foot face is exposed at the upper end of the trench, but no bedrock was found. The gravel consists of slightly angular to well-rounded material ranging in size from coarse sand to boulders up to 3-1/2 feet in diameter. Mining costs by any method would be excessively high because of the predominance of the boulders. Panning of gravel from the face of the trench indicates that the material is very low-grade. More encouraging results might be had from bedrock material.

Nearly all of the ground along the creek is held by location; Medberry and Robinson are the principal holders.

Vine Creek

Vine Creek is a small stream that empties into the North Fork 5.7 miles above the mouth of Dahlonega Creek. On September 2, 1938, the creek flow at the new workings was estimated to be 1 to 2 cubic feet per second. The stream gradient for the first quarter mile above the old workings is 480 feet to the mile. Other parts of the creek have approximately the same gradient.

For about three-quarters of a mile above its mouth the valley of Vine Creek contains gravel deposits 100 to 200 feet wide. These gravels apparently are deep and, so far as known, have never been tested for gold. For the next three-quarters of a mile upstream the creek flows through a narrow canyon, parts of which contain gravel deposits 20 feet or more wide. Above the canyon the valley bottom widens to 100 to 200 feet and is occupied by gravel deposits that apparently are 10 to 15 feet deep. They were not surveyed beyond a point about 1/2 mile above the upper end of the canyon.

Just above the upper end of the canyon are evidences of old hand workings where a narrow cut was mined along the west side of the gravel deposit for about 450 feet. According to local reports, this cut yielded good returns.

Late in the summer of 1938 the upper valley of Vine Creek was located by Harry Mitchell and Max Bauer, who dug a bedrock cut about 50 feet long just below the old workings. When visited, they had not yet done enough work to determine the value of the deposit.

Although boulders are common, they did not appear to be numerous enough to interfere seriously with mining. The valley is heavily timbered.

Pierce Creek

Pierce Creek enters North Fork from the east about 6 miles above Dahlonega Creek. The gradient is 150 to 200 feet in a mile. In June 1938 the flow was 4 to 6 cubic feet per second.

Stream-gravel deposits are continuous along the lower end of the creek for about 1-3/4 miles. Above this (fig. 5) are two smaller deposits - one about 1/2 mile long and one 3/4 mile long. They are separated from the larger deposit and from each other by short canyons.

The creek bottom ranges in width from 100 to 250 feet. About 1-1/2 miles up from the mouth a small amount of placering was done, apparently by hand. This is the only evidence that mining had ever been done in the stream gravels anywhere along the creek, although many test pits were dug. The gravel is about 8 feet deep; boulders 1 foot or more in diameter are uncommon. No definite information is available as to the gold content of the gravel, but residents of the district generally consider that gold exists in sufficient quantities to warrant working. The deposit probably could be worked best by a small dragline plant.

Most of the ground is patented as placer-mining claims belonging to an association of five persons living in Butte, Mont. It is assessed to D. S. Mathews, 1125 East Mercury St., Butte, Mont.

Lick Creek

Lick Creek is a very small tributary of North Fork about 1-1/4 miles south of the mouth of Dahlonega Creek. Its valley is occupied by very narrow gravel deposits for about 1/2 mile above its mouth; here it widens to a meadow 100 to 200 feet wide by 1/2 mile long. Above the meadow the valley again narrows to a V canyon, which contains small patches of gravel in a few places.

There is no evidence of placer workings along Lick Creek. During most of the year it is virtually dry. Furthermore, there is no easily available water supply from other sources. The scarcity of water may account partly for the absence of workings.

So far as could be learned, no holes have been sunk to bedrock in the Lick Creek meadow. The evidence available indicates that the gravels in the widest part of the basin may be 40 or 50 feet deep.

The presence of rich gold veins at the Golden Reward mine at the head of Lick Creek and at various other points in the drainage basin suggests that the gravels may be gold-bearing and in places workable if a way of overcoming the water shortage could be devised. At present the only apparent means of supplying water would be by pumping from the North Fork, which would involve a lift of 300 feet to the upper end of the meadow. Under present conditions and in view of the small yardage available, it is not likely that this would be economical.

The gradient of Lick Creek meadows is approximately 140 feet to the mile. From the North Fork to the Golden Reward mine the average gradient is 340 feet to the mile.

Sheep Creek

Sheep Creek is one of the major tributaries of the North Fork of the Salmon River. It empties into the North Fork about 3 miles south of the mouth of Dahlonega Creek and about 7-1/2 miles north of the main Salmon River. The stream gradient is approximately 150 feet in a mile. In the latter part of August 1938 the flow was estimated at 20 to 25 cubic feet per second. The valley contains a large volume of gold-bearing gravel, in parts of which commercial concentrations of gold are known to occur. At the mouth of Sheep Creek (see fig. 5) is a large triangular area of low-bench gravels. These gravels are on a series of benches, the highest about 75 feet above the present stream bottom. There is no evidence that any mining or systematic testing has been done in this area. Any gold that may be contained in these gravels is probably buried under a considerable depth of overburden. The surface is covered with many large boulders.

From its mouth to the confluence with Little Sheep Creek, the valley is a V-shaped canyon that contains in its bottom gravel deposits averaging less than 100 feet in width but which in some places are 200 feet wide. In many places the deposit is cut out almost completely by rocky promentories. The gradient of this part of Sheep Creek is about 120 feet to the mile and therefore too flat for hydraulicking. The copious flow of water renders it unsuitable for hand placering, and the frequent rocky defiles and large boulders would be a serious obstacle to dredge or dragline operations. In view of the presence of gold higher up Sheep Creek and on Little Sheep Creek, these gravels probably are gold bearing, but they have never been tested or worked seriously.

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There is evidence of some recent hand placer mining on a very small scale at the mouth of Little Sheep Creek. About 1/4 mile above the mouth of Little Sheep Creek the valley widens slightly. For the next 2-1/4 miles upstream it contains gravel deposits 50 to 250 feet wide. The average width was estimated to be about 130 feet. At several points the valley bottom is constricted locally by alluvial fans from tributary gulches. There are also several large talus slopes, which have contributed many boulders to the surface of the gravel deposits. This part of the valley is heavily wooded throughout; in places there are stands of good saw timber.

There is no evidence that mining or careful testing has been done along this part of Sheep Creek. The gravels appear to be moderately deep, fairly free from large boulders, except locally, and are probably gold-bearing. If the gold content is high enough, the ground might be workable by a dragline outfit.

Except for a small deposit at the mouth of the South Fork of Sheep Creek, the next 1-1/2 miles upstream is barren of commercially valuable gravel deposits.

For about 3/4 mile below the mouth of Pruvan Creek, on the southeast side of Sheep Creek, and for about 1/4 mile above on the other side, are deposits of low-bench gravels 300 feet or more wide. At the extreme lower end of these benches a pit about 450 feet long by 150 feet wide has been hydraulicked; water was brought by ditch and flume from Pruvan Creek. The gravel in the pit is about 15 feet deep, and the bedrock is about 30 feet above Sheep Creek. It was estimated from the tailings dump that the gravels contain approximately 5 percent by volume of boulders 1 foot or more in diameter, but none over 2 or 3 feet in size.

Bureau of Mines records show a production from Sheep Creek of 142 ounces of gold between 1901 and 1932. If this came from the pit above described it would indicate an average value of about 13 cents a yard. There is no certainty, however, that all of this came from the one pit or, on the other hand, that all gold produced was recorded. It was stated locally that panning around the edges of the pit indicated a gold content of 25 to 50 cents a yard (gold at $35 per ounce).

Above Pruvan Creek are several pits of considerable age in the bench deposits on the northwest side of Sheep Creek. The largest of these pits is about 150 feet in diameter. The gravel is 10 to 20 feet deep and appears similar in character to that in the larger pit below Pruvan Creek.

Stream deposits up to about 100 feet in width adjoin the bench deposits described above. There is also a small meadow half a mile or so above the forks northwest of the bench deposits. So far as known, these have not been tested.

One of the chief obstacles to the development of the Sheep Creek deposits has been their relative inaccessibility. The upper end of the road up Sheep Creek from the North Fork of the Salmon is still 5 miles below the

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lower end of the bench placers. There is a foot trail up the creek from the end of the road, but above Little Sheep Creek it is in poor repair. At present the nearest approach by road to the bench placers is by way of Big Hole Pass at the head of Dahlonega Creek and thence to the head of Sheep Creek. Descent into the valley may be made by trail only.

The Sheep Creek placer deposits are held by Dr. T. P. Carnes of Salmon.

Hughes Creek

Hughes Creek empties into the North Fork of the Salmon about 2 miles below Sheep Creek and about 5-1/2 miles above the settlement of North Fork (see fig. 5). For about 5 miles above its mouth it contains almost continuous deposits of stream gravel. These stream gravels have never been worked, but several large bench deposits along the creek have been hydraulicked on a moderately large scale with reportedly excellent returns.

The gravel deposits at the mouth of Hughes Creek are about 200 feet wide. It is claimed locally that one hole drilled near the mouth of the creek indicated 27 cents to the yard in gold over a depth of 14 feet to bedrock.

About 1/2 mile above the mouth of the creek the deposit narrows to about 100 feet and, with local variations, maintains this average width to about 1/2 mile above the mouth of Allan Creek. The valley narrows gradually to a narrow canyon about 1-1/4 miles above Allan Creek.

Local residents report that about 6 miles above the upper hydraulic workings on Hughes Creek there is gold-bearing gravel in a meadow about 1 mile long and 100 to 300 or 400 feet wide. The gravel is said to be about 11 feet deep and to contain many boulders. It was not visited by the writers.

On the east side of Hughes Creek just above the mouth of Ditch Creek is a worked-out bench deposit about 1/3 mile long and 50 to 100 yards wide. This bench is said to have been hydraulicked in the late 1890's by a man named Belcher. No record of production is available, but it is generally believed that the operation was profitable. After the hydraulicking was discontinued, work was continued in a small way by hand methods for many years. Tailings from these workings have been spread over the bottom of Hughes Creek Valley for some distance below the pit.

A few hundred yards above the mouth of Allan Creek is the lower end of a large deposit of bench gravel 300 to 600 feet wide, which extends up Hughes Creek for about 6,000 feet, partly on the west side and partly on the east side. At the lower end of the deposit the top of the bench is 60 feet above Hughes Creek at its easterly edge and 80 feet above at its westerly edge. Two hydraulic pits have been worked at the lower end of the bench. The first or southernmost pit was worked intermittently for about 18 seasons between 1885 and 1912 by one of the present owners (R. E. Allan and his father). This pit is about 300 feet long by 100 feet wide. Another more recent pit, about 200 feet long by 100 feet wide, has been mined a short distance north of the original workings. Allan stated that in the early days the old pit often yielded $10 per day per man to a crew of seven men using one giant. He stated that the ground was richer on the west side near the mountain tha on the easterly or outer rim.

In 1938 Leo L. Hagel purchased the southern half of the bench and installed hydraulic equipment. He began working along the outermost edge of the northerly pit. At this point the ground was only about 6 feet deep but became rapidly deeper toward the mountain. The deposit is probably 20 to 30 feet deep on its westerly edge. The gravel is relatively free from large boulders. The gold is coarse enough to be saved easily; according to Allan, nuggets weighing as much as 1 ounce have been found. The gold assays about 936 fine.

From its mouth to the Hagel mine, Hughes Creek has an average gradient of 120 feet to the mile. Below Ditch Creek the flow was roughly estimated at 20 cubic feet per second early in July 1938. Above Ditch Creek the flow was probably about half this amount.

The valley of Hughes Creek is heavily wooded. Aside from this, operating conditions are generally favorable. The adjoining mountain slopes are moderate, and there are no very narrow canyons below Allan Creek. Bedrock is composed of the metamorphosed pre-Cambrian sedimentaries common to this area. The extreme lower end of the valley is patented agricultural land (grazing). Most of the remainder of the Creek is held as patented mineral land by various owners.

Some gold production from Hughes Creek was reported to the Bureau of Mines for 15 of the 32 years from 1901 to 1932, inclusive. During this perio the recorded production was 695 ounces.

Ransack Creek

Ransack Creek is a small tributary of Hughes Creek, into which it empties about 1-1/2 miles above the confluence of Hughes Creek and the North Fork of the Salmon.

A few hundred yards above the mouth of Ransack Creek is the lower end of a narrow deposit of bench gravel, which extends upstream about 1/4 mile along the east side of the creek. A series of hydraulic pits extends along the entire outer edge of the bench. In most places bedrock slopes steeply upward away from the creek. None of the pits have been mined more than 100 feet back from the edge of the bench. The gravel is about 6 feet deep on the outer edge of the bench next to the creek but deepens quickly to 15 or 2 feet on the inner edge next to the hill.

In the spring and early summer of 1938, A. C. Miller operated a 4-inch giant under about a 40-foot head near the upper end of the bench with water from the spring floods of Ransack Creek. The gravel was washed in 27-inch sluice boxes, the upper 12 feet of which was provided with pole cross riffle and the lower 20 feet with longitudinal pole riffles. Miller stated that he recovered $300 from about 1,200 yards of gravel. He also stated that most of the gold was found along the outer edge of the bench.

Very little unworked ground remains on this bench or, as far as could be determined, at any other point along Ransack Creek. Except for a very limited yardage of tailings-covered gravels near the mouth of the creek, the stream deposits of Ransack Creek are too small to be workable.

Ditch Creek

Ditch Creek enters Hughes Creek from the north about 1/4 mile above Ransack Creek. The extensive bench gravel deposits along the west side are believed to have no value as placer ground. They are not shown on the map.

Dahlonega Creek

Dahlonega Creek flows into the North Fork of the Salmon River about 1 mile south of Gibbonsville (fig. 5). The lower 6 miles of the creek contains a nearly continuous deposit of gold-bearing gravel; for about 5 miles of this distance the deposit is almost virgin.

At its junction with the North Fork, the gravel of Dahlonega Creek valley is about 300 feet wide. Above the junction the deposit narrows gradually to about 100 feet at Gibbonsville; the depth throughout this distance is probably 20 to 50 feet. For about 0.3 mile below the mouth of Anderson Creek the Dahlonega Creek gravels are covered with tailings from old hydraulic workings on Anderson Creek.

From Gibbonsville to the mouth of Threemile Creek the Dahlonega Creek bottom ranges in width from 50 to 100 feet. From Threemile Creek to the mouth of Thompson Gulch the width is 100 to 300 feet.

A 10-foot shaft was sunk recently near the mouth of Smith Creek. A drift driven a short distance north from the bottom of this shaft did not reach bedrock. Near the mouth of Threemile Creek evidences of old placer workings extend over about half an acre. Apparently this is the only work that was ever done on this part of Dahlonega Creek. Nothing definite is known regarding the depth or average gold content of its gravels. The stream gradient is approximately 150 feet to the mile.

About 0.1 mile above the mouth of Thompson Gulch the stream gradient steepens to approximately 300 feet to the mile. For the next 3/4 mile upstream the gravels have been worked intensively by hand or small-scale hydraulic methods. Between the lower end of these workings and the mouth of Thompson Gulch several small tributary gulches on the south side of Dahlonega Creek also have been worked. The Dahlonega Creek workings indicate a gravel depth of from about 6 feet at the lower end to 10 to 15 feet at the upper end. In most places the workings are 20 to 30 feet wide. Very few large boulders but many up to 1 foot in diameter were observed in the tailings dumps. It is said locally that this section of Dahlonega Creek produced about $75,000 (gold at $20.67 per ounce). If so, the gravels would average between $2 and $5 a yard if figured on the basis of $35 gold; this estimate of production probably is high.

Some gravels continue above the worked-out area, but the creek bottom is so narrow and rocky that mining, even on a very small scale, would be difficult. Furthermore, the water flow is adequate for mining only during high water. Past operators made extensive use of boom dams.

At the end of June 1938 the water flow in upper Dahlonega Creek was about 1/2 cubic foot per second. This flow is increased gradually by important tributaries, such as Nez Perce Creek, Threemile Creek, and Anderson Creek, to an estimated 10 to 15 feet per second at the mouth.

So far as could be determined, the bedrock throughout the length of Dahlonega Creek is composed of metamorphosed and frequently silicified sedimentaries.

The fact that the gradient below Thompson Gulch is too flat for hydraulic operations may account for the lack of work along this part of the creek. It is worthy of note that the worked-out section begins exactly where the gradient steepens. Although the limited yardage and occasional "reefs" between Thompson Gulch and Gibbonsville would not favor dredge operations, all or part of this section might be worked with dragline equipment.

Below Gibbonsville the gravels should have been enriched by erosion from the veins of the Gibbonsville district and from Anderson Creek. If rich enough, this ground could be worked in connection with possible dredging operations on the North Fork of the Salmon.

Most of Dahlonega Creek from above Gibbonsville to Thompson Gulch is owned by the J. E. O'Rourke estate of Butte, Mont. Below Gibbonsville the bottom lands are held under agricultural patents by several owners.

Anderson Creek

Anderson Creek empties into Dahlonega Creek about 1/4 mile below Gibbonsville. Gold-bearing gravel deposits of commercial size extend upstream about 1-3/4 miles above its mouth. These deposits are about 300 feet wide near the mouth but narrow to 50 feet near the road crossing (fig. 5), 1-1/4 miles upstream. From that point to the forks the deposits range from 25 to 50 feet in width.

The Anderson Creek gravels are deep and contain many large boulders. This doubtless is the principal reason that they have not been intensively worked. The only large-scale operation was about 1/4 mile above the mouth. Here a pit approximately 100 feet wide, 300 feet long, and 40 to 50 feet dee was hydraulicked about 30 years ago. A hydraulic elevator was used to dispo of the tailings. It is said that the gravel was rich near bedrock but that the overlying ground was very low-grade or valueless. Several attempts have

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been made to drift-mine from the bottom of the abandoned hydraulic pit. A local informant, who had been associated with several drift-mining ventures in this ground, stated that a recovery of $2 per 4- by 5-foot set was common. Erratic paystreaks yielded as high as $70 a set. Drift mining on bedrock was handicapped seriously by water and was abandoned many years ago upon the exhaustion of the most easily accessible high-grade paystreaks.

About 1-1/4 miles above the hydraulic pit approximately 50 cubic yards of gravel on the west side of the creek has been moved recently. The ground at this point appeared to be 30 to 40 feet deep; it contained a large number of boulders up to about 1 foot in diameter but few of larger size.

Anderson Creek has a gradient of 200 to 250 feet to the mile. The stream flow on June 30, 1938, was estimated roughly at about 2 cubic feet per second.

Threemile Creek

Threemile Creek is one of the larger tributaries of Dahlonega Creek. It flows from the north, entering Dahlonega Creek about 3 miles east of Gibbonsville. The gradient is about 160 feet in a mile; the flow is 6 to 8 cubic feet per second.

Stream gravels extend upstream from the confluence with Dahlonega Creek for over 2-1/2 miles. They range in width from 75 to nearly 400 feet and in depth from 6 to 15 feet, with 2 to 3 feet of topsoil overburden. At the lower end the gravel is well-rounded, with few boulders up to 10 inches in diameter. At the upper end the gravel contains more large material, and much of it is slightly angular.

About 1/4 mile of the lower end of the creek was worked by hand and ground-sluicing methods. From the appearance of the upper end of the workings it would seem that low-grade material was found, as there is evidence that prospecting was done by trenching before the work was stopped. A few fairly rich pockets have been found just above the workings, but it is doubtful if there are enough of these to raise all of the gravel to commercial grade.

The lower end of the creek is held by location by Lon Easby of Gibbonsville. Perry Pearson and Robert Hazel of Gibbonsville are holding unpatented claims at the upper end.

Fourth of July Creek

Fourth of July Creek (fig. 6) empties into the Salmon River about 5 miles above North Fork post office. Large areas of bench gravel below the mouth of Little Fourth of July Creek were not mapped because it was extremely improbable that they were workable as gold placers. They are now used as farm land.

Above the mouth of Little Fourth of July Creek are about 3 miles of stream-gravel deposits with old workings at several places. Furthermore, the creek drains a region cut by a number of high-grade gold veins. The stream-gravel deposits are several hundred feet wide in the widest part; the average is probably not over 100 feet. The surface is covered with large boulders, and the entire deposit probably is "heavy" ground. The creek gradient is about 300 feet to the mile. The stream flow early in July 1938 was estimated at about 20 feet per second.

Bench Gravels of the Gibbonsville District

North Fork Placer

The North Fork placer is a deposit of high-bench gravels of commercial grade on the west side of North Fork opposite the mouth of Dahlonega Creek. It is approximately 1/2 mile long by about 1/4 mile wide and 200 feet higher than the bottom of North Fork Valley. A much smaller deposit is situated a few hundred feet farther west on a bench about 300 feet higher than the valle (fig. 5).

The gravels on the lower bench are 6 to 15 feet thick. The outer edge of the bench has little topsoil, but toward the hill the overburden becomes progressively deeper. At the face of a hydraulic pit that was being worked by the McGovern brothers in 1938, the topsoil was about 20 feet deep. The depth of topsoil probably continues to increase to the west. In most places this topsoil is a soft loam nearly free from boulders or coarse gravel.

The gravel deposit itself contains an estimated 5 percent of boulders over 1 foot in diameter. There are very few boulders, however, that could not be moved by hand. Virtually all the gold is contained in the lower 6 feet of gravel, most of it within a few feet of bedrock. According to Gerald McGovern, approximately 100,000 yards of gravel was moved in 1937, fr which $22,000 was recovered - an average of 22 cents per cubic yard. In the summer of 1938, one clean-up from work on the western face of the pit indicated an average value for the 20-day period of approximately 50 cents per cubic yard of gravel, excluding topsoil. The gold is about 950 fine.

So far very little work has been done on the upper bench; however, two small pits have been mined on the south end next to Votler Creek. The groun at this place is said to have yielded good returns. The upper bench is higher than the ditch that brings water to the lower bench, and consequently mining operations would be severely handicapped by lack of water.

Placer mining on both benches has the advantage of cheap, adequate tailings disposal by dumping over the nearly vertical cliff to the North Fork or Votler Creek Valleys.

The ground covering both benches is owned by A. D. Burrow of Gibbonsvil In 1938 it was under lease and option to the McGovern brothers.

John and Gerald McGovern have been hydraulicking the lower bench for several years. The gravel is cut and swept into the sluice boxes with one

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giant, using a 6-inch nozzle. During low water the nozzle size is reduced to 4 inches. Water for piping is taken from the North Fork through 4 miles of ditch to a penstock, thence through about 500 feet of 18-inch steel pipe to a Y. From the Y, the water is distributed through 12-inch steel pipes to two monitors, which are used alternately in different parts of the pit. Surplus water from the ditch is used as wash water. On June 30, 1938, the wash water was estimated at about 4 cubic feet per second. Water for the monitor was delivered under a total head of 90 feet. Friction losses would reduce the effective head to about 50 feet. The discharge through a 6-inch nozzle would be about 10 cubic feet per second at a nozzle velocity of about 54 feet per second. The total volume of water used was therefore about 14 cubic feet per second or 560 miner's inches.

The operators stated that approximately 500 yards of gravel was moved per 24 hours. The water duty, therefore, was slightly less than 1 cubic yard per miner's inch per 24 hours. When relatively large amounts of the topsoil overburden were handled the water duty probably was considerably higher.

Boulders too large to be washed through the sluices were removed and stacked by hand. Late in the season of 1938 a caterpillar bulldozer was purchased and used to stack boulders, loosen overburden, and perform other miscellaneous services. Its use for stacking boulders on rough bedrock resulted in frequent break-downs and was said to be unsatisfactory.

Sluice boxes are 26 inches wide in the clear and set at a grade of 1 inch to the foot. It was stated that this size and slope were determined, after considerable experimenting, to be the most satisfactory for the amount of water and material handled. Several types of riffles had been tried; the gold, however, was relatively easy to save, and any standard riffle seemed to be satisfactory.

The number of men employed varied from day to day. As a rule about 10 men were employed on three shifts. The work is directly supervised by the owners. In addition to the operating force, several men cleaned bedrock by hand on a royalty basis.

The operating season lasts from about April 15 to November 1. In past seasons it had been necessary to reduce the nozzle size from 6 to 4 inches during the latter part of the summer. In 1938, however, it was thought that it would be possible to use the 6-inch nozzle throughout the season.

Anderson Creek

The bench-placer deposits of Anderson Creek are just west of its confluence with Dahlonega Creek. Two benches are indicated by the surface contour, but there may be more. The first of these benches is 60 to 75 feet above the creek level and the second 100 to 125 feet above.

Most of the lower bench has been hydraulicked off. Schist bedrock is exposed for about 700 feet in length and from 50 to 100 feet in width.

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Crossing the mined area at about the center is a vein bearing N. 40°E. and dipping about 60° S.E. The disintegration of this vein probably contributed to the gold of the gravel. The vein has been prospected to some extent, but there has been little or no production from it.

Because of the difficulty of getting water to it, no placering has ever been done on the upper bench. While walking over the ground, no excavations were observed, although it was probably prospected by the early-day miners. The ground is owned by the Saurge estate of Butte, Mont.

Bench Gravels on North Fork Above Dahlonega Creek

Bench-gravel deposits extend intermittently along each side of North Fork from Dahlonega Creek to within a few miles of its source. Beginning at Dahlonega Creek and extending upstream along the east side for over a mile is a bench deposit ranging in width from 50 or 60 feet to nearly 700 feet. The same bench extends up the north side of Dahlonega Creek for about 1/4 mile Very little if any placering has ever been done on this deposit. It is 50 to 75 feet above the creek level. Water could be brought to it without difficulty; the lack of interest shown by the old timers would indicate the lack of enough gold for commercial exploitation.

At Crone Gulch and Elk Creek are small deposits of minor importance. These are more like alluvial fans than true bench-gravel deposits. They consist mostly of debris from Crone Gulch and Elk Creek. There may be bench gravels under this debris, but it is unlikely that they would have any commercial value because of the large amounts of overburden.

On the west side of the creek about a mile below Twin Forks Creek is a bench deposit nearly 1/2 mile long. It has never been worked, but residents of Gibbonsville state that it was prospected to a limited extent; no definite information is available as to its value as placer ground.

From Twin Forks Creek to about a mile above West Fork Creek, the bench-gravel deposits are almost continuous. At a place just south of Twin Forks Creek they were prospected and tested in the summer of 1938. A mile of ditch from Twin Forks Creek was excavated and a pipe line built from its lower end to the west edge of the deposit. From 150 to 200 miner's inches of water at a head of about 80 feet was available in July. Some preliminary piping was started in August, but steady production had not begun when the property was last visited.

The deposits on the west side of North Fork Creek above Twin Forks Cree are very extensive, extending along the stream for 4 miles. They are continuous, except for a short stretch of about 1/2 mile just below Little Moos Creek. Two well-defined benches can be traced from just north of Twin Forks Creek to about 1/2 mile above the confluence of North Fork and Pierce Creeks The maximum total width of the two benches is about 1,500 feet. No placerin and very little prospecting have ever been done on these deposits between Twin Forks Creek and Little Moose Creek. Much of the gravel is on agricultu claims belonging to Bart Achord of Gibbonsville; the ground is being used for agricultural purposes.

A small amount of work has been done on the deposits above Little Moose Creek. Much of the material consists of large angular rocks from the adjacent hillside. Boulders 1 to 3 feet in diameter constitute about 8 percent of the total volume. The ground belongs to A. H. and S. C. Smith of California.

At the confluence of Pierce Creek and North Fork Creek is a small bench deposit on the east side of North Fork. Very little is known of this deposit, but inasmuch as no work has ever been done on it, it might be presumed to be of doubtful value as placer ground and similar in nature to the large deposits on the opposite side of the creek.

About a mile north of this and on the same side of the creek is another deposit, much greater in extent than the one at Pierce Creek. It ranges in width from 300 to 700 feet and is about a mile long. On the upper side of the bench is a ditch 4 feet wide by about 2 feet deep. The source of water supply is partly Little Moose Creek and partly North Fork. Several hundred feet of 14-inch pipe and a hydraulic giant constitute the rest of the equipment on the property. The ditch, pipe line, and giant have not been in use for several years, but they are in a fairly good state of repair and could be put in condition for use at relatively small expense.

Two small pits have been started, one at the south end of the deposit and one about 1/4 mile farther north. The gravel at these pits is about 20 feet deep. It consists almost entirely of well-rounded material; 1 percent or less is as large or larger than 1 foot in diameter.

The deposit is covered by placer-mining claims belonging to A. H. and S. C. Smith of California.

Trowbridge Bar

Trowbridge bar is a deposit of high-bench gravel on the east side of the North Fork about 1/2 mile south of the mouth of Lick Creek. This bar is approximately 200 feet higher than the bottom of North Fork Valley. It has an over-all length of about 0.4 mile but is cut in two by a small gulch, which has removed about one-fourth of the deposit. The exact width of the gold-bearing gravel is not easily determinable because of the heavy mantle of detritus that covers it on the east, but the average width was estimated to be about 300 feet. Where exposed by workings on the eastern edge, the gravel is 10 to 15 feet deep with very little overburden. Toward the hill on the east the covering of topsoil and detritus becomes progressively deeper. These gravels are the same elevation above the present river channel as the North Fork placers and probably were deposited at about the same time.

A small yardage of gravel has been worked in the southwest corner of the Trowbridge bar in recent years. In the pit formed by these workings the gravel appears to be fairly tight but relatively free from large boulders. Water could be obtained only by pumping from the North Fork or by constructing a long ditch to Sheep Creek.

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In the summer of 1938 the ground was being tested with a view to mining with dragline or bulldozer. It was planned to dump the gravel over the west face of the bench to a trommel, whence it would drop again to sluice boxes, in which the screened gravel would be washed with water pumped from the North Fork. This method would obviate the necessity of pumping against a high head.

The ground was owned by Trowbridge and Hagel of Gibbonsville.

A small area of high-bench gravel is situated on the east side of the North Fork just below the mouth of Sheep Creek (see fig. 5). This deposit is at about the same height above the North Fork as the bench deposits of the North Fork placer and the Trowbridge bar. It apparently belongs to the same geological horizon. Nothing is known regarding its gold content.

Sheep Creek

A large deposit of bench gravels on upper Sheep Creek is described in connection with the stream deposits of Sheep Creek on page 29.

Hughes Creek

Extensive bench deposits on Hughes Creek are described in connection with the Hughes Creek stream gravels on page 31.

Pierce Creek

The only important bench deposit on Pierce Creek is on the south side about a mile up from the confluence with North Fork Creek. This deposit consists of a bench about 400 feet wide and about 1/2 mile long about 50 feet above the creek level. A small ditch near the upper edge of the bench takes its supply of water from a south tributary. Two small pits at the lower edge of the bench were made by the old timers. Ground sluicing appears to have been the method used. The deposit is covered by patented mining claims belonging to D. S. Mathews and associates, 1125 East Mercury Street, Butte, Mon

Hammerean Creek

The bench deposits along Hammerean Creek are very limited in extent. Because of the steep creek gradient it is very difficult to distinguish them from the stream deposits. A small amount of prospecting was done in the summer of 1938, but bedrock was not reached in any of the excavations. As in the stream gravels, there is a large percentage of boulders from 1 to 3 feet in diameter.

MACKINAW (LEESBURG) DISTRICT

General Discussion

The Mackinaw district is not only the largest but in the past has been by far the most productive placer-mining district in Lemhi County. In this

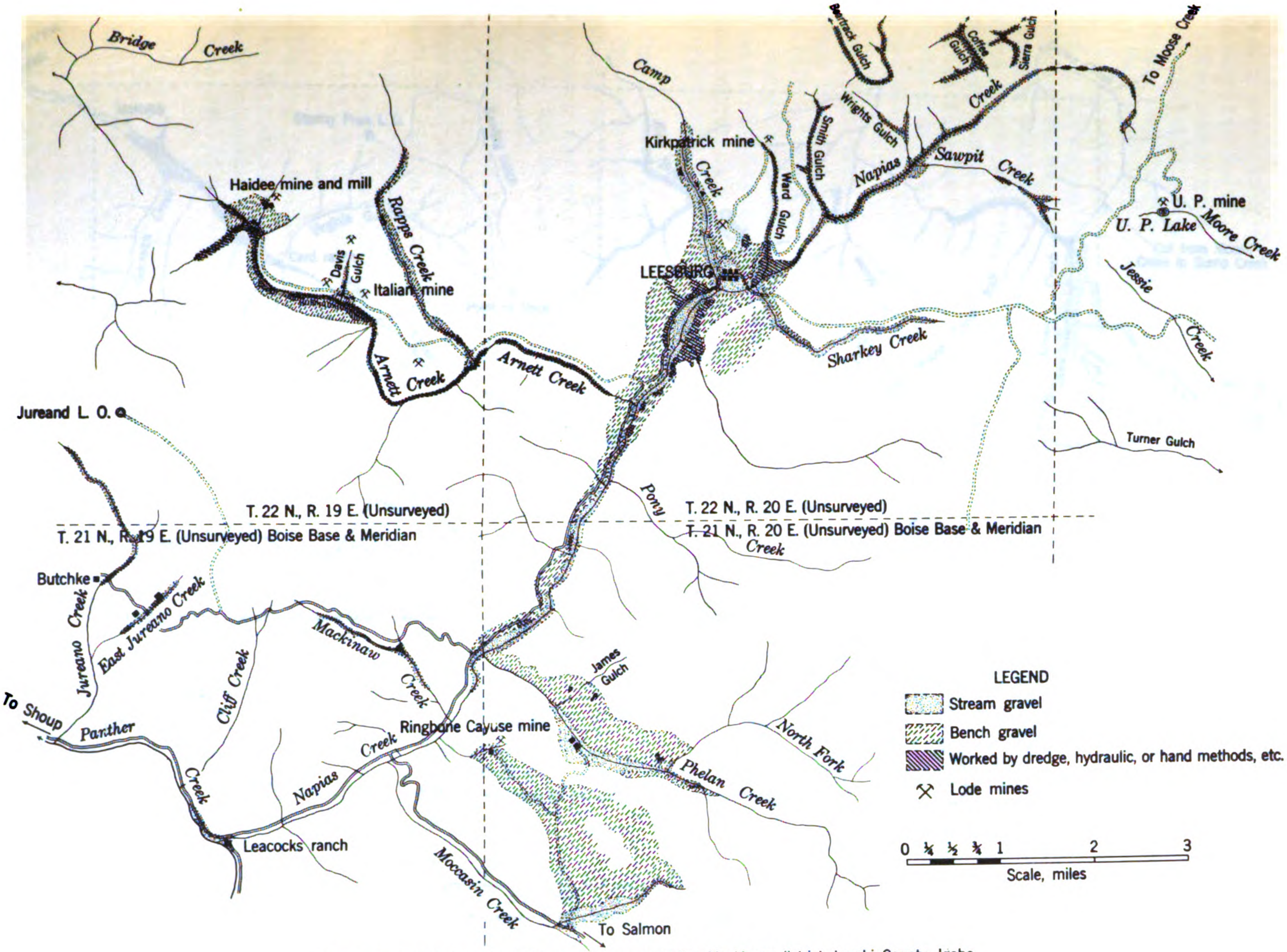

Figure 7.—Gravel deposits of the southern part of the Mackinaw district, Lemhi County, Idaho.

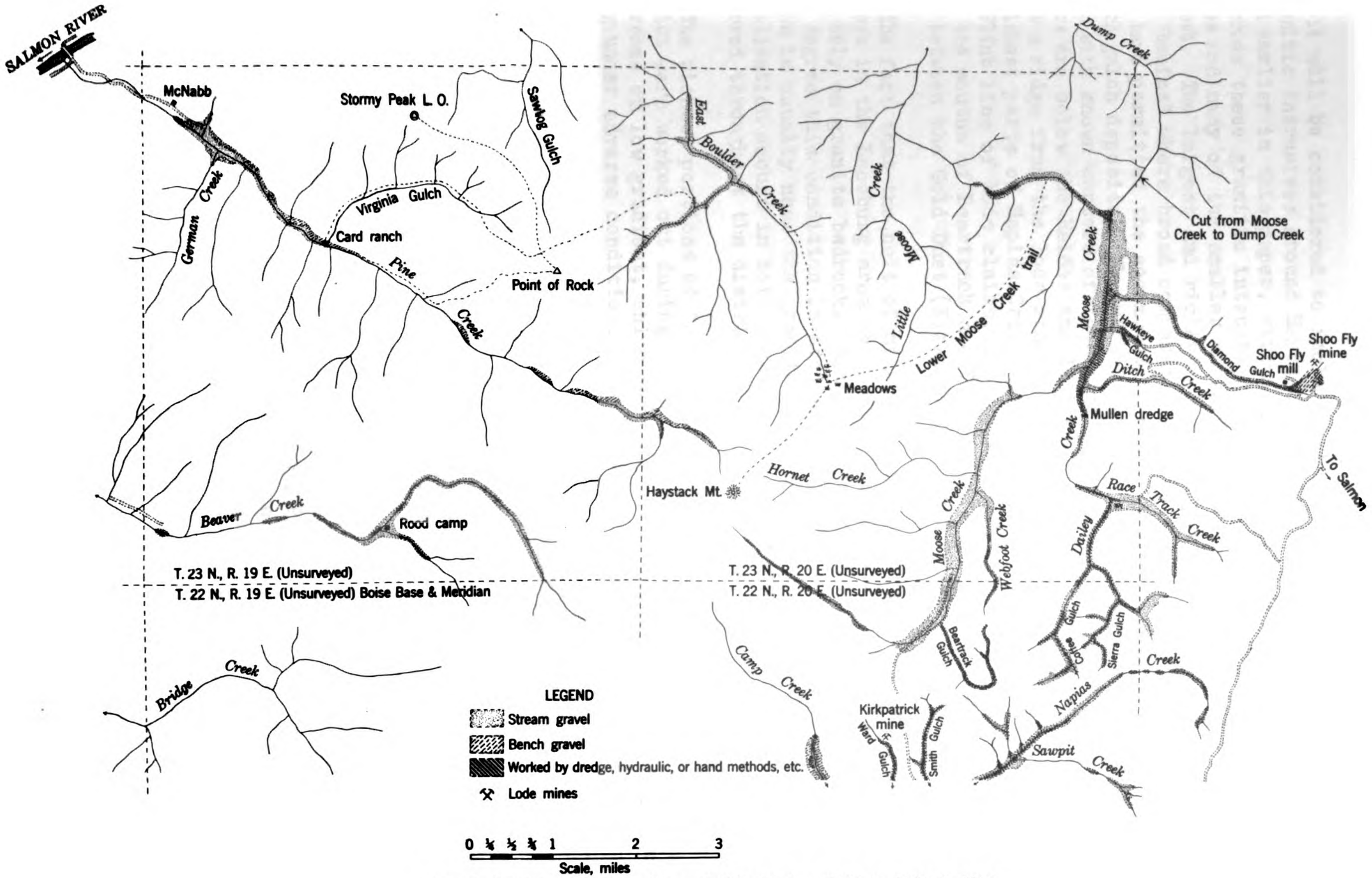

Figure 8.—Gravel deposits of the northern part of the Mackinaw district, Lemhi County, Idaho.

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paper it will be considered to include all of the streams draining the area of granitic intrusives around Haystack Mountain (see figs. 7 and 8). As stated earlier in this paper, virtually all the gravels of the streams draining across these granitic intrusives are gold-bearing. Most of the larger streams and many of the smaller streams contain placer deposits of commercial interest. The largest and richest placers are in the Leesburg and Moose Creek "basins" where broad comparatively flat stream valleys and low rounded hills have permitted the accumulation not only of large stream deposits but of rich gulch deposits. The richest gravels are invariably closely associated with known centers of lode mineralization. Thus, the Arnett Creek placers are below the Haidee and Italian lode mines, but nearby Rapps Creek, across a ridge from the lode mines, has been unproductive so far. Similarly, the richest parts of Napias Creek are just below the Gold Ridge-Gold Dust-Gold Flint line of lode claims, and the richest parts of Moose Creek are just below the mouths of Beartrack and Daly Creeks, which drain the mineralized ridge between the Gold Dust (Kirkpatrick) and Shoo Fly lode mines.

The fact that the belt of mineralization lies upstream from the granite outcrops in the Leesburg area has led to the general belief that good pay is found only on granite bedrock. Although generally true near Leesburg, to a large degree this condition is accidental. The most extensive lode mineralization is usually near the granite-sedimentary contact. Nevertheless, some mineralization occurs in both granites and sedimentaries at many points scattered throughout the district.

The richest portions of the bench and gulch placers in the Mackinaw district were worked out during the early days. However, the stream gravels on streams of low gradient, which were not rich enough for hand or hydraulic mining under adverse conditions, have been worked in only a few places, notably by the Mullan dredge on Moose Creek.

Extensive stream deposits of proved commercial interest extend for a number of miles along Napias and Moose Creeks. Although the proved yardage on individual deposits in most instances is too small for large dredge operations, the authors believe that parts of these streams could be worked profitably by small bucket dredges or by dragline outfits. By combining a number of holdings, larger-scale operations might be profitable. Fairly large deposits of unknown gold content are present also on lower Panther Creek.

Smaller deposits of stream gravel, the value of which in most instances is less definitely known, but which might be workable by draglines or in some cases by hydraulicking, lie on Rapps, Camp, Phelan, Big Jureano, Beaver, East Boulder, Pine, and Ditch Creeks and Racetrack and Diamond Gulches.

Large yardages of virgin bench gravel remain near Leesburg and on Rapps, Arnett, Phelan, and Panther Creeks. Although the best of these were worked extensively in the early days, higher gold prices and improved equipment may increase the workable yardage substantially. None of these deposits have been tested carefully since the price of gold was raised. The Richardson bench near Leesburg and some of the Arnett Creek bench gravels have been worked continuously on a small scale since their discovery.

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The small gulch deposits of the district generally were the richest and, consequently, the most nearly worked out in the early days. Because of the relative inaccessibility of the district, however, they have been reworked less extensively by "snipers" than have similar deposits in most old placer districts. In the summer of 1938 fair wages were being made by hand workers on upper Napias Creek, Daly Creek and its tributaries, Beartrack Gulch, Wrights Gulch, Wards Gulch, and on several of the bench deposits of the district.

New discoveries of some importance may remain to be made in the district. This is indicated by the recent discovery of good pay gravel in virgin ground on Beaver Creek.

In the summer and fall Leesburg is accessible to automobile travel by way of either Williams Creek Summit or Panther Creek. In winter it may be reached only by horse-drawn stage over the Jessie Creek-Sharkey Creek wagon trail. A poor road, which may, however, be traveled by automobiles in dry weather, connects Leesburg with upper Moose Creek over a 7,500-foot summit. Automobile travel from Leesburg to lower Moose Creek must follow a circuitous road via Williams Creek Summit. Second-rate mountain roads also extend up Arnett Creek and to near the head of Big Jureano Creek. Other parts of the Mackinaw district can be reached from Leesburg by trail only. Regions north of Haystack Mountain usually can be reached more conveniently by trail from Panther Creek or from the Salmon River.

Stream Gravels of the Leesburg Basin

Napias Creek

Napias Creek (fig. 7), which is 14 miles long, flows into Panther Creek from the northeast about 8 miles southwest of the town of Leesburg. The gradient ranges from a minimum of 100 feet to a maximum of nearly 400 feet in a mile, the steepest part of the stream being the first 2 miles below the source. From Panther Creek to Phelan Creek the gradient is about 185 feet in a mile. From Phelan Creek to about a mile above Jackass Gulch it ranges from 100 to about 165 feet in a mile. At Panther Creek the midsummer flow of Napias Creek is 35 to 50 cubic feet per second.

From Panther Creek for a distance of about 3 miles upstream Napias Creek flows through a narrow canyon in which there are no important gravel deposits Beginning about 1/4 mile below Phelan Creek and extending upstream for about 3-1/4 miles is a deposit of stream gravel known as California bar. The maximum width of this deposit is about 700 feet; the average is 350 to 400 feet. At one or two places it narrows to a width of 75 feet or less. Except for these pinches, at no place is the width less than 200 feet.

The gravel of California bar ranges in depth from 10 to 40 feet, the deepest being at the lower end. Bedrock consists of decomposed granite. At several places there is evidence of the gravel having been worked by hand methods. The extent of the old workings, however, is not known because most of them probably have been covered by wash brought down by spring floods.

It is logical to assume, however, that whatever work was done was near the surface above the water level, as the miners who worked by hand methods had no means of handling seepage water. A large part, if not all, of the gold on bedrock probably remains intact. Small amounts of tailings from hydraulic workings just below Leesburg have been deposited on top of original gravel. Dilution from this source, however, probably is unimportant, as most of the tailings were deposited farther up the creek.

All of this section of the creek was drilled thoroughly in recent years. It is stated that the results of this drilling indicate a total of 2-1/2 million yards of dredgable ground. The property belongs to The Calbar Co., 417 Beason Bldg., Salt Lake City.

From Arnett Creek to Camp Creek, a distance of about 2 miles, the creek bottom of Napias Creek ranges in width from about 150 feet to nearly 1/4 mile. The general character of the gravel deposits is very much the same as those of California bar. Little is known of the extent of early workings, if any. According to William Shoup, of Salmon, the original stream gravels are nearly virgin but are covered to a depth of several feet with hydraulic tailings from the bench placers on each side of the creek. Most of the ground from Arnett Creek to Camp Creek is patented and belongs to Mrs. Jessie R. Shoup and family of Salmon.

At Leesburg just above Camp Creek the creek bottom is several hundred feet wide. The ground here is virgin and largely free from hydraulic tailings.

Recent drilling on Napias Creek opposite the Richardson bar workings is reported to have proved the stream gravels to be of commercial value.

From Sharkey Creek to Upper Napias Creek Falls the creek bottom is narrow and in many places covered with hydraulic tailings. Just below the falls the creek deposit consists largely of boulders 3 to 10 feet in diameter; a small area that was worked is said to have been rich. Pioneers of the district stated that nuggets worth $50 were taken from Napias Creek at the Falls. A narrow gorge filled with large boulders extends several hundred yards upstream from the Falls. This gorge is generally believed to be very rich, but attempts to work it by drift mining or by removing the boulders with a derrick have proved unsuccessful. This ground belongs to D. E. Sayer and J. M. Gangles of Tacoma, Wash.

From Upper Napias Creek Falls to Smith Gulch, a distance of approximately 1/2 mile, the stream deposits, including a narrow bench on each side, are 200 to 300 feet wide. The only mining along this section of the creek apparently was done at a few places where small amounts of material were mined from the sides of the gulch. The creek bottom is covered with tailings from workings farther up the creek. Granite boulders 3 to 6 feet in diameter are common in a few places and would present difficulty to a mechanical operation of any kind. The ground is held by location by D. E. Sayer and J. M. Gangle of Tacoma, Wash.

Beginning at Smith Gulch and extending upstream for 3 miles, the strea deposits are continuous and range in width from 100 to 500 feet. About 1/4 mile of the lower end is covered with tailings. The lower 2 miles of this section of the creek bottom has been worked in the center for a width of 50 to 75 feet, leaving an unworked strip 50 to 100 feet wide on each side; only at one place was the whole bottom worked. From the old workings, it appears that the depth of the gravel is 8 to 12 feet. Well-rounded boulders up to a foot in diameter or larger make up 2 to 5 percent of the aggregate. At the upper end some of the material is slightly angular. Boulders up to 6 feet in diameter are common in a few places where the creek bottom is narrow and steep.

The ground from Smith Creek to Sawpit Creek is held by D. C. Sayer and J. M. Gangles of Tacoma, Wash.

The upper 1-1/2 miles of Napias Creek is very steep, having a gradient of 350 to 400 feet in a mile. The creek bottom is alternately steep and flat forming a series of small meadows with steep rocky canyons between. The deposits forming the meadows consist of material ranging in size from small gravel to rocks over a foot in diameter and in character from slightly rounded to sharply angular. The depth to bedrock is 6 to 8 feet.

Near the upper end of the creek, a small amount of material was worked recently by Tom Sears and John Marlow, who hold the ground by location.

Phelan Creek

Phelan Creek (fig. 7) flows into Napias Creek from the east about 4-1/2 miles below the town of Leesburg. During August the flow is 12 to 15 cubic feet per second. About a mile of the lower end of the creek is in a rather narrow canyon in which there are no stream gravel deposits of importance. The gradient along this section of the creek is 200 to 225 feet in a mile.

Stream deposits extend from the head of this canyon for about 2 miles upstream. The creek bottom has a maximum width of about 1,500 feet and an average of 400 to 450 feet. At the upper and lower ends the width probably is less than 100 feet.

Very little is known of the stream gravels of this creek. Just above the canyon a cut 300 feet long by 8 to 10 feet wide was made to bedrock. Little information about this work is available. It seems quite certain, however, that gold was found, but to what extent remains unknown. Work was abandoned shortly after bedrock was found, presumably because the gradient t the creek was too low to provide drainage.

Nearly all of the creek bottom of any importance is patented as agricultural claims. The lower end is cultivated extensively. The property belongs to F. E. Waterman of Leesburg.

Mackinaw Creek

Mackinaw Creek (fig. 7) is the most westerly important tributary of Napias Creek from the north. It contains deposits of gold-bearing gravel along the upper 1-1/2 miles of its course. These gravels have been worked on a small scale in a few places.

For the distance of slightly less than a mile where it parallels the Jureano Creek road, Mackinaw Creek lies in a shallow upland valley. Nearly all past work on the creek has been along this section. The most westerly working is a narrow bedrock cut about 600 feet long and 6 to 10 feet deep; the deposit continues west of the cut for about half a mile but is evidently narrow and shallow. Below the bedrock cut the creek enters a small, narrow gorge, through which it flows to the forks (fig. 7), where it turns southeastward. Along this gorge, on the south side of the creek is about 250 feet of hydraulic workings about 50 feet wide and about 12 feet deep on a bench 10 feet above the creek.

According to the owner, the gravel from these workings yielded about 25 cents to the cubic yard in gold; he was of the opinion, however, that considerable gold had been lost in clay from the bedrock. Below the pit the bench is approximately the same size, but unworked, for slightly over two-tenths of a mile to the forks.

Below the forks, the creek flows through a deep V canyon, which contains gravel deposits 50 to 100 feet wide, for about 1/2 mile downstream. This deposit is said by the owner to be about 10 feet deep and to pan gold from the grassroots down. It has never been tested systematically. The surface is covered with many boulders up to 5 feet in diameter.

The stream gradient is about 300 feet to the mile. When visited, nearly all the water from Mackinaw Creek had been diverted through a ditch to Napias Creek. The ditch was roughly estimated to be carrying one or two second-feet of water on August 2, 1938.

All of Mackinaw Creek is held as mining locations. H. J. Gordon of Leesburg holds the ground above the forks; Frank Edwards of Leesburg holds the lower end.

Arnett Creek

Arnett Creek empties into Napias Creek 1.7 miles southwest of Leesburg. It has been mined extensively from source to mouth, a distance of approximately 6 miles. Estimates of early production vary widely; the amount of ground worked indicates a possible production of 1 to 2 million dollars.

Most of the early work was below the Italian mine (see fig. 7). Since 1914, however, mining has been confined chiefly to stream, bench, and residual or side-hill placers lying between the Italian and the Haidee lode mines. A small but steady production has come from this area from 1914 up to the

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present time. During the 20 years from 1914 to 1933, inclusive, the officially recorded placer production from Arnett Creek has been approximately 1,329 ounces of gold and 111 ounces of silver. Since 1933 the yearly rate of production has increased slightly. Nearly all of the stream gravels of Arnett Creek have been worked. Small unworked areas remain at the confluence of Arnett and Rapp Creeks and at the Italian mine. Yahoo and Shenon Gulches also have been worked extensively, although some small patches of "sniping" ground may remain. Other small areas of workable ground may be found along the edges of the old workings on Arnett Creek and along small tributaries of Arnett Creek. Gold from this area assays over 900 fine.

The largest remaining gold-bearing deposits on Arnett Creek are the bench deposits extending along the west side of Arnett Creek from a short distance below the Italian mine to the mouth of Shenon Gulch, a distance of 1.7 miles. In 1938 the lower bench was being worked at three places along its northeastern edge. Crist Stucky worked just below the Italian mine, William Swan operated opposite, and the Goff brothers mined about 1 mile above. Although the deposit is 1/4 mile or more wide at its widest point, only the outer or north edge has been tested. Here the gravel is 12 to 20 feet deep and generally free from boulders over 1 foot in diameter; where mined, it was said to average 15 to 20 cents per cubic yard. Charles Goff states that the Goff brothers operations have yielded an average of $5.50 per man per day for the last 5 years. The outer edge of the bench is 10 to 30 feet above Arnett Creek, which at the Italian mine is approximately 7,000 fee above sea level. Bedrock undoubtedly rises toward the mountain.

In addition to the bench deposits above described, there is a large area of residual gravel and side-hill wash lying below the old Haidee lode mine and a smaller area below the Italian lode mine. Gold in these alluvial deposits undoubtedly was derived from erosion of the lode outcrops. Most of the gold in Arnett Creek probably came from the same source. Side-hill placers have been worked by small-scale hydraulicking from time to time on both the Haidee and Italian deposits. The largest of these operations was on the Haidee side-hill deposit, where some years ago the Goff brothers mine a pit about 250 feet wide by 500 feet long by 6 to 8 feet deep. This pit is 350 feet higher than Arnett Creek.

Goff brothers placer. - Charles J. Goff and brother have conducted hydraulic mining operations on upper Arnett Creek and adjoining ground each season since 1917. In 1938 they were mining the bench on the southwest side of Arnett Creek about 1 mile above the Italian lode mine. Water for mining was taken from Upper Arnett Creek. A storage reservoir is situated at the mouth of Shenon Gulch. The following account of their operating methods was published recently by Gardner and Johnson[10].

> The gravel ranged from 1 to 20 feet thick, the average being 12 feet. Water was brought to the mine through two ditch lines, 3 and 2 miles long, respectively. The ditches were 30 inches wide and 24 inches deep. The total capacity was 500 miner's inches; the average flow was 150 inches. The head at the mine

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[10] Gardner, E. D. and Johnson, C. H., Placer Mining in the Western States, Part II: Inf. Circ. 6787, Bureau of Mines, 1934, p. 54.

from one ditch was 75 feet and from the other 150 feet. Piping in 1932 was done with a No. 1 giant using a 1-3/4- or 2-inch nozzle. By-wash water was used for booming. The reservoir had an automatic gate, which opened when the reservoir filled. Boxes were 18 inches wide and 18 inches deep and had a grade of 4-1/2 to 8 inches per 12 feet of box. Pole riffles made up in 30-inch sections were used. Grass roots were used under some of the riffles to catch fine gold. Quicksilver was not used in the boxes. Boulders were piled by hand on cleared bedrock. Beginning at the giant, bedrock was cleaned up by piping a layer of bedrock into the sluice.

Two men, the owners, worked one shift per day. The season lasted about 125 days;[11] and about 10,000 cubic yards of gravel was washed. At $3.50 per day the labor cost would be 9 cents per cubic yard and the total operating cost about 10 cents.

Rapps Creek

Rapps Creek flows into Arnett Creek about 2 miles west of the Napias Creek. Although Rapps Creek gravels are known to be gold-bearing and several attempts have been made to work them, production has been negligible. Undoubtedly the gravels are much lower-grade than the original stream gravels of Arnett Creek. However, systematic testing may prove the existence of gravels that could be worked profitably by modern methods with gold at $35 per ounce.

In July 1938 Harmon and Ralstead were hand-mining just above the mouth of Rapps Creek. The gravels were 4 to 6 feet deep with very few boulders over 1 foot in diameter. The gold appeared to be distributed somewhat irregularly. It was stated that in some places pans containing 75 colors were taken from bedrock.

Approximately 0.2 mile above the mouth of Rapps Creek hydraulic equipment was installed about 10 years ago, and a pit 300 feet long and about 100 feet wide was excavated. A rough estimate of yardage mined against reported production indicates a gold recovery of about 0.01 ounce of gold per yard. Water for this operation was taken from Rapps Creek through about 1/2 mile of 18-inch pipe. The pipe is still on the ground and appears to be in good condition.

Stream gravels are continuous for about 2 miles above the mouth of the creek; they have been worked in a few places on a small scale. None of the operations, however, appear to have been successful. These stream deposits range in width from 20 to 200 feet; the average width is probably between 50 and 100 feet. Above the dam the channel is so narrow as to be generally unworkable by mechanical methods. The stream gravels appear to be 6 to 12 feet deep, but may be much deeper in places. The stream gradient is 250 feet to the mile.

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[11] A letter received from Charles Goff late in 1938 states that the usual operating season is 145 days.

Bench deposits averaging close to 300 feet in width are almost continuous along the northeast side of Rapps Creek from the mouth to the dam (fig. 7). Above the dam there are bench deposits on both sides of the creek. The deposits above the dam were not examined but are said to extend upstream another 6,000 feet and to have a total width, including the stream channel, of about 700 feet. Gold in commercial quantities is reported to have been found in several places throughout the length of these bench deposits. So far, however enough testing has not been done to prove or disprove the commercial possibilities of this ground. Obviously it was too low-grade to be worked in the early days. The bench deposits, however, are said to be 30 feet or more deep, and good bedrock gravel may have been overlooked.

On July 27, 1938, the water flow in Rapps Creek was roughly estimated at about 2 cubic feet per second. An equal amount was being taken from the dam through a ditch to Arnett Creek.

Camp Creek

Camp Creek rises on the southern slopes of Haystack Mountain and flows southeasterly into Napias Creek a few hundred yards west of Leesburg. Althou past production from Camp Creek has been small, its valley contains large reserves of gold-bearing gravel, parts of which are known to be of commercial interest. An abandoned part of the town of Leesburg was built on flats at the lower end of Camp Creek; this may account, in part, for the fact that this area was not worked in the early days of the district.

Placer mining on Camp Creek has been confined to several narrow bedrock cuts a short distance northwest of Leesburg and some old hydraulic workings along the benches about 1 mile northwest of Leesburg.

The bedrock cuts near Leesburg were worked by hand methods. One of the largest cuts, situated on a low bench east of Camp Creek, is about 100 feet long, 10 feet deep, and 5 feet wide. No large boulders are exposed. Anothe cut along the present creek channel is about 300 feet long, 10 to 20 feet wi and 10 feet deep. Some boulders up to 2 or 3 feet in diameter are exposed. Both of these cuts are said to have yielded small grubstakes to the workers.

A few hundred yards south of Leesburg, a drift was recently driven into a low gravel bench, which, although below the confluence of Napias Creek and Camp Creek Valleys, is contiguous with the Camp Creek deposits. This drift was said to have yielded an average of 50 cents per cubic yard from 45 yards of gravel.

In addition to the above-mentioned work, a line of 10 holes was drilled several years ago across the Camp Creek Flats just north of the present site of Leesburg. The holes were 15 to 20 feet deep to bedrock; the indicated gold content of the gravel, however, is not obtainable. In places these flats are 10 or 20 feet higher than the present creek channel of Camp Creek, but nevertheless they have been mapped as stream deposits (fig. 7). About 1/2 mile above Leesburg the flats narrow to stream deposits 50 to 100 feet wide, which continue for about 1-1/2 miles up Camp Creek.

Bench-gravel deposits 50 to 100 yards wide parallel the stream deposits on both sides of Camp Creek. In the early days several old hydraulic pits were mined in the bench gravels on each side of the creek about a mile above Leesburg.

The gradient of Camp Creek is approximately 300 feet to the mile. The water flow in midsummer 1938 was roughly estimated at about 2 cubic feet per second. All of the Camp Creek placer deposits above the town of Leesburg are owned by the Leesburg Mining Co. of Leesburg. Some of the claims are patented.

Sharkey Creek

Sharkey Creek (fig. 7) is a small tributary flowing into Napias Creek at Leesburg. It had a flow of 2 to 4 cubic feet per second in July and August 1938. The gradient is 300 to 400 feet in a mile.

Stream gravels on Sharkey Creek extend from its confluence with Napias Creek for about 2 miles upstream. The creek bottom ranges in width from 100 to 250 feet. Many places are steep and rocky, and many of the boulders are up to 6 feet in diameter. Such places probably would be difficult to work either by hand or mechanically. Other places are flat and swampy, apparently with no material of unusual size.

Very little work has been done anywhere along the stream. About 1/2 mile up from the mouth are some old workings consisting of a pit 60 feet long, 30 feet wide, and 12 feet deep. The material exposed along the sides of the pit is well-rounded gravel. Boulders 1 foot or larger in diameter constitute about 5 percent of the total volume.

During July and August 1938 nearly all of the water of Sharkey Creek was being diverted through two small ditches, one on each side, to the placer operations on Napias Creek. Two small reservoirs, one about 1/2 mile and the other about 3/4 mile above the mouth, probably were used in the early days for storing water; they have not been in use in recent years.

Wards Gulch

The original discovery of gold in Leesburg Basin was made at the mouth of Wards Gulch near the northern edge of the present townsite of Leesburg. This gulch and the adjoining bench deposits, although little more than 1 mile long, are estimated to have yielded about $1,000,000 in placer gold.

The stream gravels of Wards Gulch have been worked extensively from the mouth to about 1/2 mile above the road crossing (fig. 7). There are also extensive bench workings on both sides at the lower end; most of the gold credited to Wards Gulch came from these benches.

The half mile of creek bottom below the Kirkpatrick lode mine (fig. 7) ranges in width from 100 to 300 feet. Except for 200 yards below the mine, all of this part of the gulch has been worked -- the center by open methods and the "rims" on each side by drift mining. Near the upper end, where the boulders are large and the overburden thick, the drift workings are extensive

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while the open-cut workings are narrow. The change in method of working probably was influenced partly by large boulders and heavy overburden and partly by water shortage. In addition to the unworked ground just below the mine, a fair percentage of unworked ground remains along the "rims" between the old drifts. The old timers undoubtedly mined the richest pay streaks, but parts of the remaining ground may be workable at the present price of gold.

Above the drift workings is a bedrock flume 300 feet long and a hydraulic pit 50 feet long, 25 feet wide, and about 15 feet deep. The owner, O. E. Kirkpatrick of Leesburg, states that the gravel from this pit averaged about 25 cents per cubic yard with gold at $20.67 per ounce. Nearly all the gold was concentrated in about 1 foot of gravel on bedrock.

There is said to be little or no gold in Wards Gulch above the lode mine. The veins in the vicinity of this mine undoubtedly are the source of the placer gold. The placer gold assays about 680 fine - considerably less than most other placer gold in the region.

The creek gradient is approximately 300 feet to the mile. Kirkpatrick states that the patent examiners reported a stream flow of 25 cubic feet per second at high water and 1 cubic foot per second at low water. The ground above the bench deposits is patented as lode and placer claims and is owned by Kirkpatrick.

Smith Gulch

Smith Gulch (fig. 7) flows nearly due south and enters Napias Creek about 1-1/4 miles above the town of Leesburg. The gradient of the main creek is 100 to 150 feet in a mile; that of the north tributary at the head of the creek about 500 feet in a mile. The flow at the confluence with Napias Creek is about 1-1/2 cubic feet per second.

The stream gravels in Smith Gulch and all of its tributaries have been worked thoroughly. A few benches 10 to 15 feet above the stream are the only deposits left intact. The worked-out section ranges in width from 25 to 150 feet. The thoroughness with which the creek bottom has been worked would seem to indicate that the material was richer than in most other creeks of the district where only 1/2 to 2/3 of the bottoms was mined. Possibly rich spots have been left along the sides in the low-bench material.

Wrights Gulch

Wrights Gulch (fig. 7) empties into Napias Creek slightly over 2 miles northeast of Leesburg. Its two forks contain practically virgin gravel deposits throughout their length. However, a small-scale operation was being conducted in one place in 1938. Creek gravels 50 to 100 feet wide are continuous from the forks to the head of both branches.

At the forks the deposit is 200 feet wide and about 6 to 10 feet deep. Just below the forks the owners, E. E. Yarborough and son, have mined a pit about 300 feet long, 20 feet wide, and 6 feet deep to bedrock. They were making wages from this pit by hand methods in 1938. A hose with 1-inch nozzle, operating under a low head, and some wash water were used to loosen the gravel, most of which was then shoveled into the sluices by hand. No large boulders were observed. The gold was fairly coarse but contained no large nuggets; it was stated to assay about 950 fine. Pans of 10 cents to $1 each were obtained from bedrock in favored spots.

Although a small area has been worked out near the mouth, the lower 1/4 mile of Wrights Gulch contains no gravels of commercial interest.

The water flow was estimated at between 1 and 2 cubic feet per second on July 26, 1938. The owners stated that this flow would be nearly constant to the end of the season. The gradient is about 400 feet to the mile at the lower end of the gulch but appears to flatten slightly farther upstream.

Sawpit Creek

Sawpit Creek is the main south fork of Napias Creek, which it joins about 2-1/4 miles above Leesburg. The lower mile of Sawpit Creek flows through a steep, rocky canyon. The upper mile contains gravel deposits, which have been mined at one or two places on a small scale.

The largest volume of gravel on Sawpit Creek is in a comparatively broad, shallow basin near the source of the creek. The deposit is marked by open meadows about 300 feet wide by 1/2 mile long. It was estimated from the general appearance and from the small amount of work done that the gravels are 6 to 12 feet deep to bedrock, including 1 to 3 feet of topsoil. The surface is dotted with boulders up to 1 or 2 tons in weight. Some gold has been produced by small hand workings in small gulches leading into the meadows. The meadows themselves have not been tested systematically.

Below the meadows are several small, narrow deposits of stream gravel that might be suitable for "sniping" if their gold content were high enough.

The stream flow at the lower end of the meadows was estimated at about 1/2 second-foot on July 29, 1938. The altitude of the meadows is approximately 8,000 feet above sea level. The ground was being held and worked by Halver Lund.

Bench Gravels of the Leesburg Basin

General Discussion

The part of the Napias Creek drainage area usually known as the Leesburg Basin contains large deposits of low-bench gravels; they are cut by the present channels of Napias Creek and its tributaries. Bench gravels are found far up on the sides of the basin, but the most important deposits are within an area about 2 miles long, from Wards Gulch to Arnett Creek, and about a mile wide at the widest part (fig. 7). Most of the gold produced in the Leesburg Basin had been from this area.

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The largest of the old workings are at the mouth of Wards Gulch and along the southeast side of Napias Creek. Other smaller areas were worked near the mouths of Camp Creek and Jefferson Gulch and along the upper edge of the bench ground just below the lode outcroppings of the Leesburg Mining Co.

It may be seen from figure 7 that large areas of virgin bench ground remain on both sides of Napias Creek and that the worked-out areas are, for the most part, near and around the mouths of tributaries. The gravels of areas rich enough to be worked in the early days probably were reconcentrated and enriched by the tributary streams; in some instances the classification of the gravels as bench deposits may be open to dispute.

Camp Creek to Wards Gulch

The lower benches at the mouth of Camp Creek have been mapped as stream deposits and described separately (see description of Camp Creek).

A large area of low bench ground at the mouth of Wards Gulch was worked out in the early days of the camp by the "Discovery Company." The productio from this area is included in the estimate given under the description of Wards Gulch.

Midway between Camp Creek and Wards Gulch, at an elevation 200 feet above the Leesburg townsite and just below the lode outcroppings on the Gold Ridge quartz claim of the Leesburg Mining Co., is an area about 600 feet lon by 300 feet wide (fig. 7) that was worked out by Chinese miners in the early days. The remaining bench ground, comprising 40 to 50 acres between Camp Creek and Wards Gulch, is unworked. The gold content of this deposit is not known, but the average probably is low; however, it may contain pay streaks.

In 1938 Denny and Gist sunk a pit 27 feet to bedrock a short distance west of the Wards Gulch workings. The upper 24 feet of this pit was said to have yielded 2 to 9 colors to the pan; the lower 3 feet was barren. A short distance south of the pit two men had recently (1938) panned $80 from about 300 square feet along the bottom of an old ditch; this gold probably had bee reconcentrated in the ditch.

At another point along the western edge of the Wards Gulch workings some prospectors had recently tested a small area that averaged close to 90 cents per cubic yard. They were unable to do much mining, however, beca of a water shortage. They also tested several small patches of unworked ground in the old Wards Gulch workings, which they said panned up to $3 or $4 a yard. This ground evidently had been left unworked, because the gold was contained in a sticky clay.

Most of the Camp Creek-Wards Gulch bench ground is held by E. R. Denny, J. S. Gist, and Mike Fraker of Leesburg.

Camp Creek to Arnett Creek

In this area is a large volume of bench gravel, which extends up to half a mile or more northwest from Napias Creek. The bench has been worked only in a small way along the outer margins, as shown in figure 7. All the workings are situated near the mouths of small streams that cut across the bench; consequently, it may be assumed that some reconcentration has taken place along these streams.

Recent test holes along Jefferson Gulch are said to have indicated the presence of workable gold deposits; holes sunk in the adjoining bench gravels, however, were very low-grade or barren. The bottom of Jefferson Gulch averages about 100 feet in width for half or three-quarters of a mile above its mouth. Enough reconcentration may have taken place in the bottoms of Jefferson Gulch and of other gulches that cross the benches to make the gravels workable by dragline methods.

The test holes sunk in the bench gravel near Jefferson Gulch are 20 to 30 feet deep to bedrock, probably a fair average for the entire deposit. Although the work so far done on these bench gravels has not been encouraging, the unexplored area is large and there undoubtedly are a number of successive bench levels, some of which could contain undiscovered pay streaks.

Richardson or Shoup Placers

According to the owners, the deposits of bench gravel and reconcentrated stream gravel extending for about 1-1/2 miles along the southeast side of Napias Creek have yielded between one-quarter and one-half million dollars in placer gold. According to Kirkpatrick[12], the French Bar workings, which constituted an important part of the Richardson Bar, yielded $6,000 to the acre in the early days. Assuming an average depth of 3 to 5 yards, the average gold content would therefore have been 25 to 40 cents per cubic yard.

Most of the worked-out portion of this area was mined by hand methods or with crude equipment; consequently, extraction and recovery were incomplete. Many small patches of good ground were left, and tailings losses evidently were high. Many of the old tailings have since been reworked. At one place where old tailings were being reworked in 1938 all of the gold recovered was in the form of amalgam.

In addition to the work on old tailings, some work on virgin ground has continued from the early days to the present time. Statistics of the Bureau of Mines note some production from the Richardson placers for every year since 1901, when the records were begun. These data show a production of 2,304 ounces of gold and 153 ounces of silver from 1901 to 1933, inclusive. The yearly rate of production has increased slightly since 1933.

Operations around the margins of the old workings have demonstrated that parts, at least, of the large virgin bench deposits in this area, as shown in figure 7, contain commercial concentrations of gold. For instance, in

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[12] Kirkpatrick, O. E., work cited in footnote 5, page 5.

1937 a bulldozer operation on the northeastern edge of the old workings is said to have recovered about 30 cents to the cubic yard moved. In 1938, W. H. Shoup was ground-sluicing on virgin ground a short distance south of the bulldozer workings. A small sample taken by the writers at the ground-sluicing operations assayed 39 cents a yard; the gold was 870 fine. Toward the end of the season a 3-ounce nugget was recovered from the same vicinity.

As far as the writers know, the large volume of virgin gravels remaining on the Richardson Bar has never been tested thoroughly. The ground, together with the water rights from Sharkey Creek and Rabbit Creek and about 20 miles of ditches, are owned by Mrs. Jessie R. Shoup and family of Salmon.

Camp Creek

Bench deposits on Camp Creek are described with the Camp Creek stream deposits on page 48.

Rapps Creek

Extensive bench deposits on Rapps Creek are described in connection with the Rapps Creek stream deposits on page 47.

Arnett Creek

Large bench and residual or side-hill deposits on Arnett Creek are described in connection with the Arnett Creek stream deposits on page 45.

Phelan Creek

The bench gravels of Phelan Creek extend along the north side of the creek from Napias Creek eastward to North Fork, a distance of 2-1/2 miles. On the south side of the creek are two deposits of smaller proportions, one just east of the mouth of James Gulch and the other extending from about a mile below Alder Gulch to about 1/8 mile above. The deposits on the north range in width from a few hundred feet at the lower end of the creek to nearl a half mile at the upper end and in elevation from about 50 feet to about 65 feet above the creek level. The deposits on the south side are in no place more than a few hundred feet wide and range in elevation from 50 to about 10 feet above the creek level.

The deposits on both sides of Phelan Creek have been worked to a limite extent. Grant Rood of Leesburg mined 8,000 to 8,500 cubic yards by ground-sluicing in 1937 and 1938. One pit is about 800 feet east of James Gulch and 1,200 feet north of Phelan Creek; the other is about 400 feet west of James Gulch and 800 feet north of Phelan Creek. The gravel, as exposed in the pits, is about 15 feet deep with 3 to 5 feet of topsoil overburden. Boulders 1 foot in diameter or larger constitute 5 to 10 percent of the volu of gravel. Bedrock consists of firm clay. According to information supplie by Rood, the small pit to the west of James Gulch yielded around 22 cents pe cubic yard for all material worked. The one on the east was a little better

The water supply is from Pony Creek through a ditch about 1-1/2 miles long. By extending the ditch 1/4 to 1/2 mile and building a pipe line, a head of 200 to 250 feet would be available for hydraulicking.

At the east end of the bench deposit on the north side of Phelan Creek near North Fork are several pits that were worked by Lorton Prince from about 1914 to 1918. The largest of these is about 150 feet long by 100 feet wide. The gravel is 6 to 8 feet deep with 1 to 2 feet of overburden. Boulders 2 to 3 feet in diameter are more common than in the Rood workings at the other end of the deposit. The bedrock is firm clay. The work was done by groundsluicing with water from Phelan Creek. According to the only available information, which is probably not very reliable, the better-grade material from the workings yielded about 50 cents per cubic yard at the old price of gold. In recent years, the pits were operated intermittently by "snipers", who mined out a few high-grade pockets.

A small pit at Alder Gulch is the only evidence that any work ever was done on the south side of the creek. The depth and general character of the deposit are about the same as on the north side at North Fork. The work was done by Lorton Prince in about 1914 or 1915.

Virtually all of the bench deposits of value along Phelan Creek are covered by placer-mining claims owned or held by location by Grant Rood of Leesburg and James Sims of Salmon.

High Gravels South of Phelan Creek

Just south of Phelan Creek and extending eastward from the Ringbone Cayuse mine (fig. 7) for 2-1/2 miles is one of the largest single areas of bench gravels in the Leesburg district. It is about 1-1/2 miles wide in the widest place and has a total area of 800 to 1,200 acres.

The north edge of the deposit lies at an elevation of about 400 feet above Phelan Creek, or about 250 feet lower than the highest of the bench gravels on the north side of Phelan Creek. The highest point on the deposit, approximately midway between the northern and southern boundaries, is about 650 feet above Phelan Creek, or about the same elevation as the highest of the bench gravels north of Phelan Creek.

The northern part of this deposit probably was formed by Phelan Creek and the southern part by Moccasin Creek during a period when both creeks, but especially Phelan Creek, were at a much higher elevation than at present. Gold-bearing gravels occur on Phelan Creek but none have been found on Moccasin Creek; the Phelan Creek drainage, therefore, is more likely to be of commercial interest.

No information is available as to the character or probable gold content of the gravels of this deposit. From some old holes it would appear that the gravel is 8 to 12 feet deep, but the depth is likely to vary at different places. Lack of water may be one of the reasons why the deposit was never exploited. Its size alone would seem to justify a limited amount of systematic testing.

Stream Gravels of the Moose Creek Basin

Moose Creek

The placer deposits on Moose Creek (fig. 8) proper are separated by canyons into three sections, which will be considered separately as Upper Moose Creek, Middle Moose Creek, and Lower Moose Creek.

Upper Moose Creek. - Upper Moose Creek (fig. 8) flows southeasterly for about 2 miles from its source on the slopes of Haystack Mountain to a narrow canyon, below which it makes an abrupt turn to the northeast. For the last 1-1/2 miles above the canyon it flows through parklike meadows 50 to 300 feet wide. These meadows are the surface of gravel deposits of undetermined depth and value.

As far as could be determined from superficial examination, the gravel deposits are not over 20 feet deep. Not enough large boulders are present to constitute a serious obstacle to mining. No mining or thorough testing has been done on this part of Moose Creek. The gravel evidently is too low-grade for hand-mining. The deposit is too flat for hydraulicking and too small to warrant the installation of a bucket-line dredge unless it could be worked in conjunction with the deposits farther downstream. It would be suitable for dragline operations, however, if proved to contain enough gold.

Where it flows through the meadows, Upper Moose Creek has a gradient of approximately 100 feet to the mile. In midsummer 1938 the stream flow was roughly estimated at 3 or 4 cubic feet per second.

Above the upper forks the gradient steepens rapidly, and the gravel deposits narrow to 20 feet or less. The stream flow was about 1/2 cubic foot per second. In 1938 the owner, Neil Allen, was hand-mining on this section of the creek and claimed to be recovering some gold.

Middle Moose Creek. - From the canyon about 1/2 mile above the mouth of Beartrack Creek to the canyon above the Mullan camp, Moose Creek flows throu wide bottom lands that contain large deposits of gold-bearing gravel. The upper 2-1/4 miles of this section has been thoroughly drilled and proved to contain commercial concentrations of gold.

From the lower end of the upper canyon down to the mouth of Hornet Cre the bottom land is 300 to 400 yards wide and may be wider in places. Below Hornet Creek the valley narrows slightly, then widens gradually to about 1/ mile near the upper end of the lower canyon. As it enters the lower canyon Moose Creek swings gradually eastward, and the bottom lands become correspondingly narrower. The canyon bottom is 100 to 200 feet wide but is strew with many very large boulders. A dredge possibly could dig itself through this canyon enroute from Middle to Lower Moose Creek, but commercial dredging in the canyon would not be feasible.

Throughout the entire distance between the upper and lower canyons the Moose Creek gravels appear to contain very few large boulders. Drilling results indicate a uniform depth of 20 to 30 feet to bedrock. The highest concentrations of gold are near the mouth of Beartrack Creek. Below here the gold content is said to become progressively lower and the pay streak narrower to the mouth of Hornet Creek, at which point only a narrow channel in the center of the valley is of commercial grade. Very little if any drilling has been attempted below the mouth of Hornet Creek. It is possible, however, that a narrow pay streak continues down to the canyon.

The stream flow in midsummer was roughly estimated at 5 to 10 feet per second. The gradient is approximately 100 feet to the mile.

All of the ground on Middle Moose Creek is owned by Neil Allen. The Placers Exploration Syndicate of Spokane, Wash., recently drilled the upper 2-1/4 miles.

Lower Moose Creek. Mullan placers. - For about 2-1/2 miles below the lower canyon, Moose Creek flows northerly through wide bottom lands, which contain, or have contained, large deposits of gold-bearing gravel. This part of Moose Creek, including the lower end of Daly Creek, has been one of the most productive placer areas in Lemhi County. In spite of the large past production, a very considerable yardage of commercial-grade gravel remains, as has been proved by recent drilling.

The Lower Moose Creek placers were first owned and mined by David McNutt in the latter part of the last century. According to Kirkpatrick[13] and others, McNutt's operations yielded about $1,000,000 in gold. The work was done between the mouths of Daly Creek and Diamond Gulch (see fig. 8), chiefly by hand and hydraulicking. To facilitate tailings disposal, McNutt drove a tunnel through from the Dump Creek drainage and tapped Moose Creek where it swings northwest at the lower end of the present Mullan holdings. The creek has now cut a permanent channel along the course of the tunnel, leaving the old stream bed dry below this point.

In 1899 the ground was purchased from McNutt by the Pacific Dredging Co. for a reputed $75,000. A dredge with a daily capacity of 350 to 500 yards was built and operated two seasons; the third season it blew up. A new dredge was then built; but the company failed, and the boat was laid up in 1904. About 1906 or 1907 the ground and dredge were purchased by the present owner, John Mullan. During succeeding years Mullan dredged 2,100 feet downstream from his camp, then turned and dredged up Moose Creek to Daly Creek and about 1/2 mile up Daly Creek, where the dredge was accidentally capsized and sunk in 1919. Since then Mullan and others have worked the old tailings and some virgin ground on a small scale, chiefly by ground-sluicing and shoveling. According to Bureau of Mines records, Moose Creek is credited with a yield of 6,755 ounces of gold and 385 ounces of silver from 1901 to 1933, inclusive; however, the earlier records may be incomplete. The gold is about 930 fine.

The old stream deposits on Moose Creek above Diamond Gulch were 600 to 900 yards wide. Although most of these were worked over by McNutt and later operators, many of the old tailings are claimed to carry commercial values. Above Daly Creek the Moose Creek gravels are virtually unworked and probably are much lower grade; evidently the best pay streak goes up Daly Creek to the canyon. The deposits on lower Daly Creek are approximately the same width and depth as those on Moose Creek.

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[13] Kirkpatrick, O. E., work cited in footnote 5, p. 5.

From a short distance below Diamond Gulch to the old Dump Creek tunnel, Moose Creek has cut a deep, narrow trench through the Miocene lake beds that fill this part of the valley and contain a number of thin seams of lignite. Although there are some gravel deposits on and in the old lake beds, there is no indication that they have ever been worked as placer ground.

From the lower end of the lake beds to the mouth of Daly Creek are low-bench deposits several hundred feet wide on both sides of the Moose Creek stream deposits, shown on the map (fig. 8) as stream gravels. These bench gravels have never been worked. Recent drilling indicates, however, that parts of these deposits as well as remaining sections of virgin stream gravels and old tailings are suitable for dredging.

The Moose Creek deposits are 10 to 20 feet deep and relatively free from boulders. The creek gradient below the mouth of Daly Creek is about 50 feet to the mile but may be slightly steeper above this point. The mid-summer stream flow was roughly estimated at 10 to 15 cubic feet per second.

Edwards or Rocky Mountain placer. - For about 1-1/2 miles below the old Dump Creek tunnel, at the lower end of the Mullan ground, the now dry channel of Moose Creek swings sharply westward through a valley bottom 100 to 300 feet wide and containing nearly virgin deposits of gold-bearing gravel. Thes deposits are owned by W. J. Edwards of Salmon.

The gravels range in depth from about 11 feet at the upper end to about 40 feet at the lower end of the Edwards ground. A glacial moraine at the lower end probably dammed the creek at one time. Just below the moraine are two small meadows, below which the stream channel enters a steep canyon. In the deep ground on the upper side of the moraine is an old placer cut 50 to 200 feet wide and about 0.3 mile long; many boulders were observed in the cut Some old workings at the extreme upper end of the Edwards ground constitute the only other work done on this part of Moose Creek. Lack of water may be responsible for the small amount of work done.

During the summer of 1938 the owner sank a shaft to bedrock near the upper end of his holdings. He stated that the hole averaged 30 cents per cub yard in gold.

Beartrack Gulch

Beartrack Gulch (fig. 8) is said to have been one of the richest gulche worked in the early days of the Leesburg and Sierra districts. It rises on the mineralized ridge between the Napias Creek and Moose Creek drainage basi meanders in a general horseshoelike curve through swampy upland for about half its course, and then flows northwesterly into Moose Creek. In the early days it was worked intensively from its mouth to some swampy meadows near its source. Although some gravel remains along the edges of the old placer cuts, the present owner states that very few spots are worth working.

Parts of the swampy meadows near the course, however, have yielded good returns in recent years. The paystreak evidently was overlooked by early-day miners. At two different places the present owner, Neil Allen, has worked these meadows by hand methods; he claims recoveries as high as $10 per cubic yard. The gold is contained in a 3-1/2-foot stratum of red clay underlying thin lignite beds; the total depth is about 10 feet. The high-grade streaks appeared to be about 10 to 12 feet wide. The area covered by gold-bearing deposits of this nature is indeterminate. Several swampy meadows up to 600 feet wide by 800 feet long are scattered along the ridge in this vicinity.

Webfoot Creek

Webfoot Creek (fig. 8) rises a short distance west of the head of Beartrack Gulch on the ridge between Moose Creek and Napias Creek drainage basins. From its source, it flows almost due north into Moose Creek. It has been worked only in a small way at a few places.

The upper mile of Webfoot Creek is steep and rocky, and the gravel deposits are so small as to be suitable only for working by hand. Evidently the gravels were too low-grade to have much interest to the early miners. Only a few cuts that showed evidence of great age were observed. The largest workings, about a mile above the mouth, are comparatively recent. At this point the gravel from a bedrock cut 150 feet long, 6 feet wide, and 6 feet deep was said to have yielded good wages. There were many boulders to contend with, however. From these workings to its head, Webfoot Creek has a gradient of 300 to 350 feet to the mile. The midsummer stream flow is less than 1 cubic foot per second.

Beginning 1/2 mile above its mouth, the gradient flattens and the valley widens gradually to about 1/4 mile of meadow land at its confluence with Moose Creek. If rich enough in gold, these meadows would be suitable for dredging in conjunction with operations on Moose Creek. So far as known, they have never been tested systematically.

Webfoot Creek is said to be held by Peter McKinney of Salmon.

Daly Creek

Daly Creek (fig. 8) rises on the mineralized ridge paralleling Moose Creek on the east and flows northerly into Moose Creek. The valleys of these creeks have contained some of the richest gulch placers of the district and were worked extensively in the early days. However, many small areas of rich ground remain along the edges or above the old workings. A considerable yardage of unworked probable dredge ground also remains near the lower end of the creek.

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Daly Creek is about 4 miles long. At its extreme lower end the valley bottom is about 700 feet wide. From here to a canyon about 1 mile above the mouth it narrows gradually to about 200 feet. The gradient of this part of Daly Creek is about 125 feet to the mile. The midsummer stream flow in 1938 was estimated roughly at about 3 cubic feet per second. For about 1/2 mile above its confluence with Moose Creek, the Daly Creek gravels were dredged by John Mullan in connection with his Moose Creek operations. The remaining distance from the dredged ground to the canyon is covered with placer tailings from farther upstream. The underlying gravels, however, are believed to be nearly or entirely unworked. The flat gradient and moderate value of these gravels would have discouraged early miners. It is possible that in addition to the remaining virgin ground, the tailings and any parts of the underlying gravels that may have been worked in the early days carry enough gold to be of interest to dredge operators. Lower Daly Creek is owned by John Mullan as part of his Moose Creek holdings.

For about 1/2 mile above the flats at its lower end Daly Creek flows through a narrow rocky canyon whose gradient in places is over 600 feet to the mile.

Above the canyon the creek gradient is about 350 feet to the mile. Conditions here are favorable for working by hand methods. From the upper end of the canyon to about 1/4 mile above Sierra Gulch, the creek bottom has been worked for a width of 50 to 200 feet. The total width ranges from 100 to 300 feet, leaving 50 to 100 feet of unworked material along the sides. At Race Track Creek the depth of the gravel is 12 to 15 feet, with about 2 feet of topsoil overburden. In most places the gravels consist of a large percentage of material less than 10 inches in diameter, with only a very small percentag of boulders larger than 1 to 1-1/2 feet in diameter. In a few places, however, there are many boulders 4 to 6 feet in diameter. The early-day miners mined around the large boulders and left them in place. Above Sierra Gulch the depth of gravel ranges from 4 to 6 feet with 1 to 2 feet of topsoil overburden. The material is angular and ranges in size from sand to fragments 6 inches in diameter.

Apparently, much of the material left along the side might be worked profitably at the present price of $35 per ounce for gold. In August 1938, J. Henck and Earl Sevensen worked some of the material that was left on the west side of the creek about 1/4 mile below Sierra Gulch. A fire hose with a 3/4-inch nozzle was used for cutting and washing the material into a sluice box. Water was taken from Daly Creek and Sierra Gulch. The operators stated that the ground ran about 50 cents a yard.

The upper half mile of Daly Creek has never been worked, but a few test holes were sunk in recent years. Material from these pits consisted of angular schist fragments up to 6 or 8 inches in size. The alluvium is 3 to feet deep with 1 to 2 feet of overburden. The bottom of the present creek level is 50 to 100 feet wide. To the southeast and about 50 feet above the creek is a bench several hundred feet wide. This bench is included with the stream deposits in figure 7. Meadow Creek, a tributary from the south, flow through a meadow ranging in width from 250 to 350 feet. No placering was done along this stream.

The ground along Daly Creek from Moose Creek to Race Track Creek is held by location, mostly by John Mullan and Sheldon Edwards of Salmon. N. A. Crim owns two claims just above Race Track Creek.

Sierra Gulch

Sierra Gulch is a small tributary to Daly Creek from the south. It has a total length of about a mile, all of which has been placered. Some unworked ground remains, however, where the stream enters Daly Creek and also along the sides, where rich pockets were overlooked by former operators. According to J. W. Pendleton, the owner, one such pocket yielded an average of $15 per man-shift for several days.

In August 1938, Pendleton and C. E. Lee were working with a mechanically operated rocking sluice at the junction of Sierra Gulch and Daly Creek. The gravel is slightly round to sharply angular and ranges in size up to about 6 inches. It is 5 to 6 feet deep with about 2 feet of overburden. According to Mr. Pendleton, the gravel runs from $1.25 to $1.50 per cubic yard. The gold is very coarse. Nuggets worth $1.50 to $1.75 are common, and some worth $10 have been found. Rocking sluices are used almost exclusively during the summer months, as they require but little water. Ground sluicing is sometimes practiced early in the season when enough water is available.

A tributary about 1/2 mile long joins Sierra Creek from the west about 1/4 mile above Daly Creek. The stream deposit ranges from 50 to 200 feet in width and 2-1/2 to 3 feet in depth, with 1 foot of topsoil. It consists mostly of angular fragments, with little material over 6 inches in size. Practically all the tributary is virgin; the lower half apparently is rich, and the upper half is unproved. Tailings from hand workings contain an unusually large amount of rim material.

The first mining operation on the tributary was that by C. E. Lee in the summer of 1938; he leased the property from J. W. Pendleton. The material treated had to be shoveled twice - once into a rocking sluice, in which it was washed, and then onto a tailings pile. The miners make $4 to 4.25 per day of 4 to 6 hours. In 14 days two men took 74.25 pennyweight of gold from approximately 84 yards of material exclusive of overburden, indicating a value of $1.40 per cubic yard. The gold was 940 fine.

Racetrack Creek

Racetrack Creek is the largest tributary of Daly Creek; it enters from the east about 2 miles above Moose Creek. Stream gravels along this creek are more extensive than along any of the other tributaries. The width of the creek bottom at Daly Creek is about 1,000 feet; at the forks, about a mile up from the mouth, it is about 350 feet. Stream gravels extend up each fork for about 1/2 mile. The width of the creek bottom of the north fork averages about 300 feet and that of the south fork about 150 feet.

The depth of the gravel in Racetrack Creek at Daly Creek averages 8 to 12 feet, with about 2 feet of overburden. At the forks the depth is 4 to 6 feet with 1 to 2 feet of overburden. The stream gradient is about 125 feet to the mile.

The gravel is virgin except for two small worked-out areas at the lower end near Daly Creek. The old timers worked a narrow channel 200 feet long in about the center of the creek bottom at its confluence with Daly Creek. Sheldon Edwards, the owner, has been working for the past seven seasons on the south side of the creek bottom just east of Daly Creek.

Coffee Gulch

Coffee Gulch rises on the same mineralized ridge as Beartrack and Sierra Gulches; it has also been an important producer of placer gold. From its source Coffee Gulch flows northeasterly about 1-1/2 miles to Daly Creek, which it joins about 3 miles above the confluence of Daly Creek with Moose Creek.

Coffee Gulch was worked from end to end in the early days, but a boulder-strewn section about 1/4 mile above its mouth was not completely exhausted. This section, about 1/4 mile long, contains gravel deposits 50 to 100 feet wide; it was being worked with light hydraulic equipment in a small way in 1938. A cut about 100 feet long, 10 feet wide, and 6 to 10 feet deep was said to have yielded about 50 cents per cubic yard in gold. The water supply gave out about July 15, and operations ceased for the season. Water could be brought to the ground by ditch from Daly Creek.

In addition to the section of partly worked ground described above, there are some swampy meadows near the source of Coffee Gulch similar in appearance to the gold-bearing meadows at the head of Beartrack Gulch. Some work has been done on the Coffee Gulch meadows, but information as to the results obtained was not available.

Ditch Creek

Ditch Creek is a small tributary of Daly Creek, which it joins a short distance above the confluence of Daly and Moose Creeks (fig. 8).

The extreme lower end of Ditch Creek Valley contains unworked gravel deposits that are about 600 feet wide at the mouth but narrow gradually to a short canyon about 0.2 mile above the mouth. This canyon was worked by hand methods. Above the canyon the gravels range from 50 to 300 feet in width.

A few test pits that have been sunk at irregular intervals along the stream indicate a depth to bedrock of probably 10 to 15 feet. Few large boulders were observed. Although the gravels have not been tested systematically (1938), the old hand workings at the lower end of the canyon indicate that they are gold-bearing. The ground is held by Peter McKinney and associates of Salmon.

The stream gradient is approximately 100 feet in a mile. The midsumme stream flow is less than 1 cubic foot per second; in very dry seasons the flow probably stops entirely.

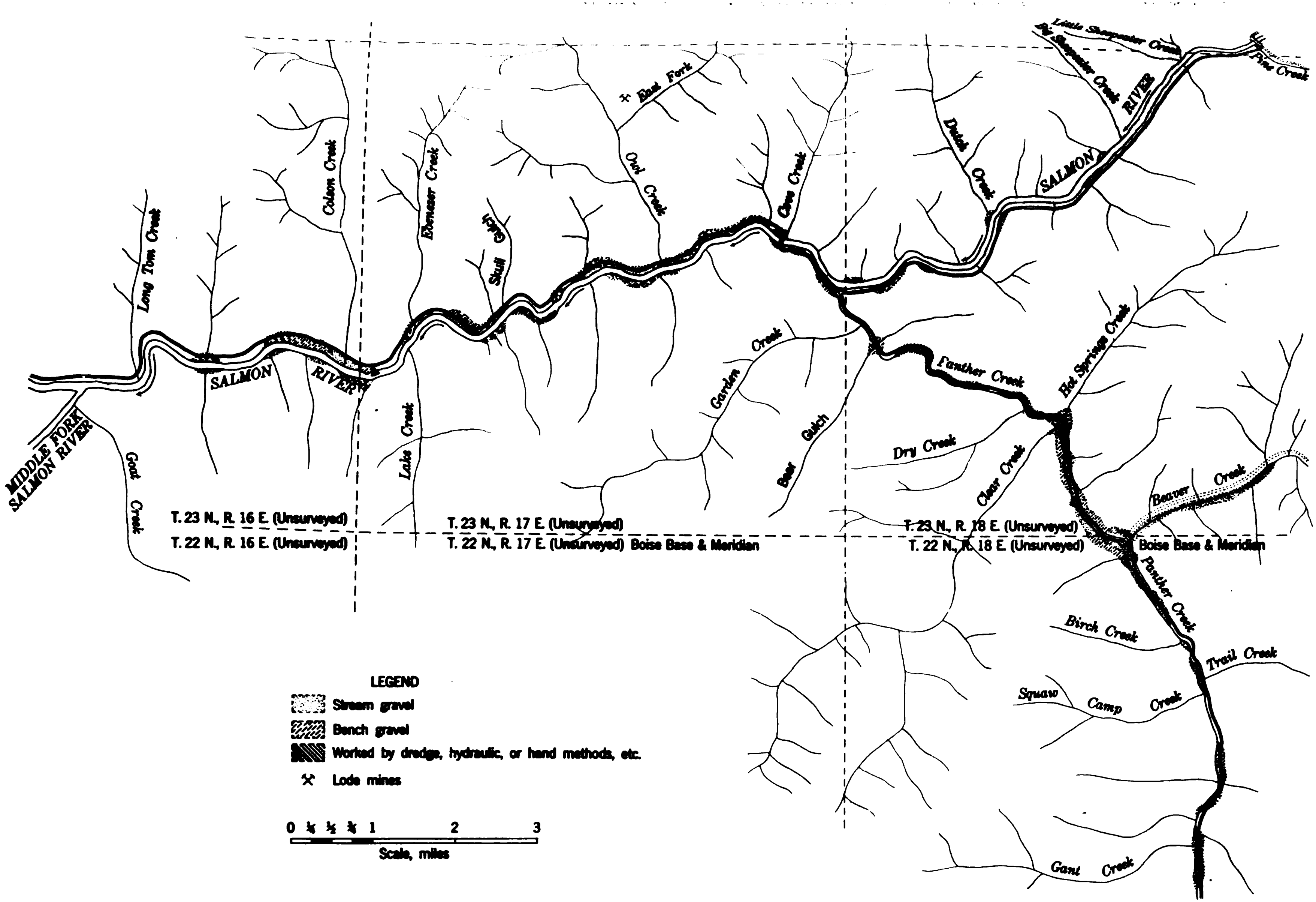

Figure 9.—Gravel deposits of lower Panther Creek and of Salmon River from Pine Creek to Middle Fork, Lemhi County, Idaho.

Diamond Creek

Diamond Creek flows into Moose Creek from the east about a mile below the confluence of Moose and Daly Creeks. The total length is about 3 miles. The gradient at the lower end is about 190 feet to the mile. At the upper end the gradient is 300 to 350 feet to the mile. The midsummer stream flow was estimated at about 3 cubic feet per second.

Stream-gravel deposits extend from the mouth nearly to the source. Just east of the confluence of Diamond and Moose Creeks, the bottom of Diamond Creek valley is about 200 feet wide.

Just above this it widens out to nearly 800 feet. From this point to the source of the creek it gradually becomes narrower; at the Shoofly mine it is about 25 feet wide.

According to John Mullan, the gravel in the meadows at the lower end of Diamond Creek is about 30 feet deep. The largest material is 8 to 10 inches in diameter. Four shafts have been sunk to bedrock, but so far as is known the ground remains unproved. It is held by Harry Talley and Albert Amonson of Salmon.

Only a limited amount of placering has been done on Diamond Creek. At the Shoofly mill, about 2-1/2 miles east of Moose Creek, the stream gravels were worked for about 400 feet over a width of about 75 feet. At the Shoofly mine there is a considerable area of residual material (fig. 8) formed by the disintegration of the Shoofly and other veins. In recent years much of this material has been shoveled into trucks, hauled to the Shoofly mill, and treated by flotation and amalgamation. According to statements of the operators, this material ran from $3 to $6 a ton.

A meadow 400 to 600 feet wide extends to the north from Diamond Gulch (fig. 8). It is approximately parallel to Moose Creek and about 3,000 feet east. There is no stream in the meadow; it is probably the ancient channel of either Moose Creek or Diamond Creek.

Panther Creek (Salmon River to Leacocks)

General Discussion

Panther Creek (formerly known as Big Creek) (figs. 7 and 9) flows along the western edge of the Mackinaw district and empties into the Salmon River 8.5 miles below Shoup. There are moderately large deposits of both stream and bench gravels along the lower 5 miles of its course. The bench gravels have been worked to some extent at two places, but no production has been made from the stream gravels. The gold-producing areas drained by Napias, Big Jureano, and Beaver Creeks form parts of the Panther Creek drainage area; this is a favorable indication that the lower Panther Creek gravels are gold-bearing and may contain commercial concentrations of gold in places. The

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richer gravels, however, are likely to be buried under a considerable depth of low-grade material brought in by the swift-flowing tributaries that plunge down the sides of its steep-walled canyon.

The gradient of Panther Creek from the Salmon River to Leacocks ranges from 90 to 100 feet to the mile. The midsummer stream flow in 1938 was estimated at 75 to 100 cubic feet per second.

Stream Gravels

The largest deposits of stream gravels are near the lower end of the creek. They begin about 1-1/4 miles above the confluence of Panther Creek with the Salmon River and occur at intervals for about 5 miles upstream to 1/2 mile above the mouth of Beaver Creek. The largest deposit is about 2-1/2 miles long and ranges in width from 150 to 500 feet; the others are of about the same width but much shorter. Most if not all of these gravels undoubtedly contain some gold, and it is possible that some of them have enough to justify working. No information is available, however, as to their probable richness, the depth to bedrock, or the character of the material. Some of the gravel areas are covered by placer-mining claims, but many are covered by agricultural claims and are being cultivated as farm lands.

At Trail Creek and 1-1/2 miles above Trail Creek are small stream-gravel deposits ranging in length from 1/4 to 1/2 mile and in width from 150 to 350 feet. If rich enough, they could be worked with a dragline plant but are too small to justify the expense of building one. It is possible that they could be worked by such a plant in conjunction with the deposits farther down the creek.

Other stream gravels along Panther Creek are small and scattered. The largest are at Napias Creek on the Leacocks Ranch, where the ground is being used as farm land.

Bench Gravels

The most important bench gravel deposits along Panther Creek are betwee Hot Springs Creek and Beaver Creek. Much of the deposit at the mouth of Hot Springs Creek consists of detrital material and talus from the mountain side Just south of where the road crosses the creek, however, it consists of well rounded material of stream origin. Parts of at least two old channels can be distinguished by the contour of the ground above the road. In August 193 a small-scale hand operation was begun on the lower channel. The operation was of little importance except that it indicated that some of the gravel is rich enough in gold to be handled by the crudest methods.

The bench deposit on the east side of the creek and just north of Beave Creek is the only one worked to any extent on Panther Creek. An old channel about 500 feet north of the road (fig. 9) and 260 feet above the creek has been worked for about 900 feet along its course. The bottom of the channel is about 18 feet wide; the maximum depth of gravel mined was about 15 feet. A total of 4,500 cubic yards was worked. Water for hydraulicking was taken through a ditch from Beaver Creek.

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Little is known of the deposits on the west side of Panther Creek opposite Beaver and Hot Springs Creeks. The two largest are each more than 1/2 mile in length and range from 150 to 350 feet in width. Inasmuch as parts of them are being cultivated, it is presumed that they are covered with a fair depth of topsoil.

Like the stream-gravel deposits, the bench deposits on Panther Creek above Beaver Creek are small and scattered. Many of them consist principally of talus and aluvial material brought down by tributary streams. Most but not all of them are too small to justify the expenditure of capital for machinery and equipment for their exploitation. However, some of them may have small concentrations of gold that are rich enough to be worked by hand methods.

Big Jureano Creek

Big Jureano Creek empties into Panther Creek about 2-1/2 miles below the mouth of Napias Creek. The upper 2 or 3 miles contain deposits of gold-bearing gravel that have been mined successfully by hydraulicking for about 600 yards above the Butschke camp (see fig. 7). The camp is at an altitude of approximately 7,000 feet above sea level.

In that part of the creek already worked, the gravel is 8 to 12 feet deep; the pay channel averaged about 50 feet wide. According to the owner, the gravel deposit continues at approximately the same dimensions for 2 miles upstream. The upper part, however, was not visited by the writers. Below the Butschke camp the stream plunges downward through steep gorges to Panther Creek.

It was roughly estimated that granite boulders 1 foot or more in diameter constitute nearly 50 percent of the total volume of gravel; many of these boulders weigh 1/4 ton to 5 tons.

The average value per yard of that part of the deposit that has been worked has not been accurately determined. A block of ground estimated to have contained about 2,700 yards was said to have yielded $1,100, or about 40 cents per cubic yard; the gold content of other sections of the channel, however, varied considerably from this figure. The gold assays about 965 fine.

The water supply is large enough to operate a 2-inch nozzle under a 100-foot head at full capacity from May 1 to about July 15. After that it is possible to operate intermittently or under a reduced head until about the middle of September.

The deposit is owned and operated by Frank Butschke & Sons of Leesburg.

Butschke Placer

The placer deposit on Big Jureano Creak has been operated for the past 5 or 6 years by the owners, Frank Butschke & Sons.

A No. 1 giant with a 2-inch nozzle and operating under a static head of approximately 100 feet is used for mining. A storage reservoir is provided for use after the subsidence of the spring floods. When full, this reservoir will supply water for the giant and wash water for 7 hours operatio

Sluice boxes are 96 feet long and 18 inches wide and set on a slope of 7 inches in 12 feet. Pole riffles are used throughout.

The deposit contains a high percentage of large boulders, which are removed from the pit by a derrick operated by water power. The derrick consists of a 50-foot mast and a 48-foot boom constructed of round timbers. Water power for the derrick is supplied through a Y and hydraulic pipe from the main pipe line. The water is directed through a 1-inch nozzle against a 24-inch-diameter Pelton-type waterwheel equipped with 2-inch buckets. The waterwheel is connected to the winch through an automobile transmission and a 5-to-1 gear reduction.

The winch drum is 8 inches in diameter. The drum is wound with 1/2-inch steel cable and equipped with a 13-inch-diameter wooden brake drum controlled by a 3-inch steel brake band and hand lever.

All rocks too large to be put through the sluice boxes are hoisted and stacked outside the cut with the derrick. Large boulders are hoisted in slings; smaller boulders are loaded on a stoneboat and dumped by a trip. It was said that boulders up to 2 tons in weight were hoisted with this equipment; not more than 25 pounds of dynamite was used in a season for breaking oversize boulders.

By the above described methods three men moved an estimated 4,000 yards of gravel in a season of approximately 90 working days.

East Fork of Jureano Creek

Gold-bearing gravel extends for about 3/4 mile along the upper end of the East Fork of Jureano Creek. At its lower end this deposit is 100 to 200 feet wide; farther upstream it narrows to 20 to 100 feet. The deposit is apparently 6 to 10 feet deep along the main channel but becomes shallower along the edges.

At the lower end of the deposit, just above where the creek drops off into a steep canyon, a cut 100 feet long, 6 to 8 feet wide, and 8 to 10 feet deep has been mined. A fire hose and nozzle were being used for cutting and a small boom dam for ground-sluicing. This cut contained many granite boulders over 1 foot in diameter; some were 6 feet in diameter.

About 300 feet above the road crossing (fig. 7) another cut about 100 feet long, 20 to 100 feet wide, and 4 feet deep was being worked in 1938 by ground-sluicing and shoveling, chiefly for testing purposes. This cut was a short distance west of the main channel in low, shallow bench gravel. Th operators stated that the ground so far worked had yielded about 50 cents

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to the cubic yard in gold. Some wolframite also was being recovered from these workings; the cut above the road was said to have yielded about an ounce of wolframite from 6 to 8 yards of gravel.

The gradient of the upper part of East Jureano Creek is about 300 feet to the mile. On August 2, 1938, the stream flow was estimated at less than 1/2 cubic foot per second. At this time the property was under option to B. L. Kinzie.

Beaver Creek

Beaver Creek empties into Panther Creek 5-1/2 miles above the confluence of Panther Creek with the Salmon River (figs. 8 and 9). The first production of placer gold from Beaver Creek was made in 1938, although several small lode-gold mines in the Beaver Creek drainage area had been worked from time to time. In 1937 pay gravel was discovered in stream deposits near the present site of the Rood camp (fig. 8); early in 1928 small-scale hydraulic operations were begun and continued throughout the season.

The lower 2 miles of Beaver Creek Valley contains large gravel deposits 200 to 300 feet wide and said to be very deep. A shaft was sunk to bedrock many years ago near the mouth of the creek; it is said to have been 60 feet deep and to have encountered a pay streak on bedrock. The gold-bearing gravels in this part of Beaver Creek Valley are in most places deeply covered with detritus from the many hillside gulches. Vegetation is predominantly grass and sagebrush. The stream gradient is approximately 250 feet to the mile. The ground is said to be owned by Mrs. Myrta Gilbert of Salmon.

About a mile of the valley consists of a narrow V canyon, which begins about 2 miles above the mouth. Above this canyon the valley widens to a small basin. The workings of E. McLaughlin are on some small bench deposits on the south side of the creek just above the upper end of the canyon. When visited, McLaughlin was doing development work on some small benches, which were suitable only for small-scale operations.

Between the McLaughlin workings and the Rood mine, about 2-1/2 miles farther upstream, there are a few small gravel deposits; most of them appear to be deeply covered with overburden. The stream gradient along this part of Beaver Creek is nearly 500 feet to the mile.

The valley widens slightly near the forks at the Rood camp. A large gravel deposit lying in the angle between the forks is partly covered with detritus and topsoil. The gravel of the main channel of Beaver Creek above the forks is 50 to 150 feet wide and 6 to 8 feet deep; it is covered with 2 to 3 feet of topsoil.

According to the owners, the gravel deposit continues at approximately the same size for 3 miles upstream. The altitude at the forks is slightly under 6,000 feet above sea level. It was not examined by the writers above the upper workings.

The Rood brothers had started a bedrock flume opposite the forks but, because of the heavy overburden, did not reach the pay streak. To obtain quicker returns, they had, toward the end of the season, moved their operatio about 1/4 mile upstream. Here they had washed off about 800 square yards of bedrock with a 3-inch nozzle operating under a head of approximately 60 feet. The water for piping and washing was obtained from the north fork of Beaver Creek. In late August 1938 the flow was roughly 3 cubic feet per second. The creek gradient is 400 to 500 feet to the mile.

The gravels at the upper pit contained a very small percentage of boulders over 1 foot in diameter. The bedrock is a decomposed schist. The gold is moderately coarse; nuggets up to 1/2 ounce have been found. Many pieces of massive iron sulfide, partly altered to iron oxide, indicate that an area of lode mineralization is not far distant.

This was one of the few discoveries of virgin placer ground made in central Idaho in recent years. Excellent results were being obtained from the small area worked. Although test pits had been sunk by old-time prospectors along the sides of Beaver Creek, they missed the pay channel.

Pine Creek

General Discussion

Pine Creek rises on the northwest slopes of Haystack Mountain and flows northwesterly into the Salmon River about 1-1/2 miles below the town of Shoup. Although its valley contains large deposits of stream and bench gravel, placer production has been negligible. There is some weak lode mineralization along its course, however, and the recent discovery of a pay channel on Beaver Creek, which also rises near Haystack Mountain, has led to renewed interest in the Pine Creek gravels. In common with other streams to the north and west of Haystack Mountain, the lower course of Pine Creek is through a deep, steep-walled V canyon; stream gravel along this section i largely buried deeply under accumulations of alluvial material from the side hills.

The part of Pine Creek below the McNabb ranch flows through a narrow rocky canyon with a steep gradient. From the McNabb ranch to German Gulch (fig. 8) the gradient is about 125 feet in a mile. Above German Gulch the gradient steepens gradually. At the upper end of the creek it is about 400 feet in a mile. The stream flow in midsummer 1938 was estimated at between 6 and 10 cubic feet per second.

Stream Gravels

The stream-gravel deposits of Pine Creek are almost entirely along two sections of the creek, one near the lower end and one near the source. The first section begins about 2 miles above the confluence of Pine Creek and the Salmon River and extends upstream for 2-3/4 miles. The width of the deposit ranges from 75 to 100 feet at the lower end, and is 750 feet just below German Gulch and 350 feet at the upper end. At the lower end near the McNabb ranch, where the creek bottom is very narrow, the gravels were worked for approximately 600 feet about 40 years ago. Little or nothing is known about the amount of gold produced. Nearly all the ground along this part of the creek is covered by the Card ranch and other agricultural claims. Henry B. McNabb holds two placer locations just above the Card ranch.

Near the source of the creek are two stream-gravel deposits. The upper one is about 1/2 mile long and from 150 to 200 feet wide, and the lower one is about 1 mile long and 200 to 400 feet wide. It is difficult to distinguish between the stream and bench deposits along this part of the creek because of the steep gradient. Deposits that may be at about the level of the stream at one place will be 50 to 75 feet above only 1/4 mile downstream.

Several pits, presumably recent discovery shafts, have been excavated in these gravels, but there is no evidence of systematic sampling. It appears from these pits that the gravel is 6 to 8 feet deep, but in places it may be more.

Sam Pipejoy, Wm. Archer, and Dave Temple, all of Lemhi County, hold locations along this part of the creek.

Bench Gravels

The bench gravels of Pine Creek are mostly on the north side and generally along the same sections of the creek as the stream gravels. Between the McNabb ranch and Virginia Gulch are two deposits, one about 1 mile and the other about 1-1/4 miles in length. Overburden of topsoil and talus appears to be deep at some places and almost nonexistent at others. Well-rounded gravel of stream origin is exposed in many places by shallow irrigation ditches.

The bench deposits near the upper end of the creek appear to be similar in all respects, except size, to those at the lower end; they are not continuous for much more than 1/2 mile at any place.

Inasmuch as no placering and very little prospecting have been done on any of the bench deposits along Pine Creek, it is impossible to gage the outlook for gold production. Pine Creek has its source in the same general section as have a number of streams that are known to have moderately rich placer deposits. This fact should encourage prospecting.

East Boulder Creek

East Boulder Creek rises on the north slopes of Haystack Mountain and flows in a northerly direction to the Salmon River, which it joins a short distance below Indianola ranger station. Throughout the lower 5 miles, the course of East Boulder Creek is through a steep, narrow canyon. For about 2-1/2 miles above the canyon it flows through comparatively level, open meadows, parts of which have been proved to be gold-bearing.

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The meadows are 50 to 300 feet wide; their average width is between 100 and 150 feet. At the lower end of the meadows, just above the canyon, an old bedrock cut 30 to 50 feet wide has been worked for about 1/4 mile. The ground in the cut is 10 to 15 feet deep and contains many large, granite boulders ranging up to about 5 tons in weight. The boulders become less numerous toward the upper end of the cut, and above the working very few boulders could be seen. The entire area evidently is underlain by a granite bedrock.

Test pits have been sunk at scattered points along the creek from the old workings to the forks about 1-1/4 miles upstream. Many of these pits are old and caved in. Three pits recently sunk a short distance below the forks are said to have been 11 to 14 feet deep to bedrock; the gravel is reported to have panned 11 cents per cubic yard in gold.

The average gradient of the meadows is about 60 feet to the mile. On August 30, 1938, the stream flow at the lower workings was estimated at about 7 cubic feet per second. The flow of the west fork, about a mile abov the forks, was estimated at 1/4 to 1/2 cubic feet per second.

The gravel deposits on the east fork are terminated by a falls about 1/4 mile above the forks. It is believed that there are other gravel deposits farther up the east fork, but they were not visited. Nearly all past work has been concentrated on the deposits described above. These deposits are approximately 6,500 feet above sea level. The ground is said to be held by William Webb of Salmon.

At present the East Boulder Creek placers can be reached by trail only. One trail follows East Boulder Creek from Indianola. Another crosses the ridge from Pine Creek near Point of Rocks. Two other trails come into the area from Moose Creek, one by way of Haystack Mountain and the other by way of Little Moose Creek.

SHOUP OR MINERAL HILL DISTRICT

General Discussion

The boundaries of the Shoup or Mineral Hill district (fig. 10) are somewhat indefinite. In this paper the district is considered as being tha area of which Shoup is the natural supply point; strictly speaking, howeve probably it should be confined to the area of intense lode mineralization adjacent to the town of Shoup.

The quartz mines at Shoup include some of the most productive and mos promising gold lode mines in Lemhi County. These mines are situated on steep slopes draining directly into the Salmon River. Placer deposits of the Salmon River will be discussed in another section.

Aside from the Salmon River placers, the Shoup district is nearly devoid of placer deposits; stream gravels, however, on upper Boulder Creek

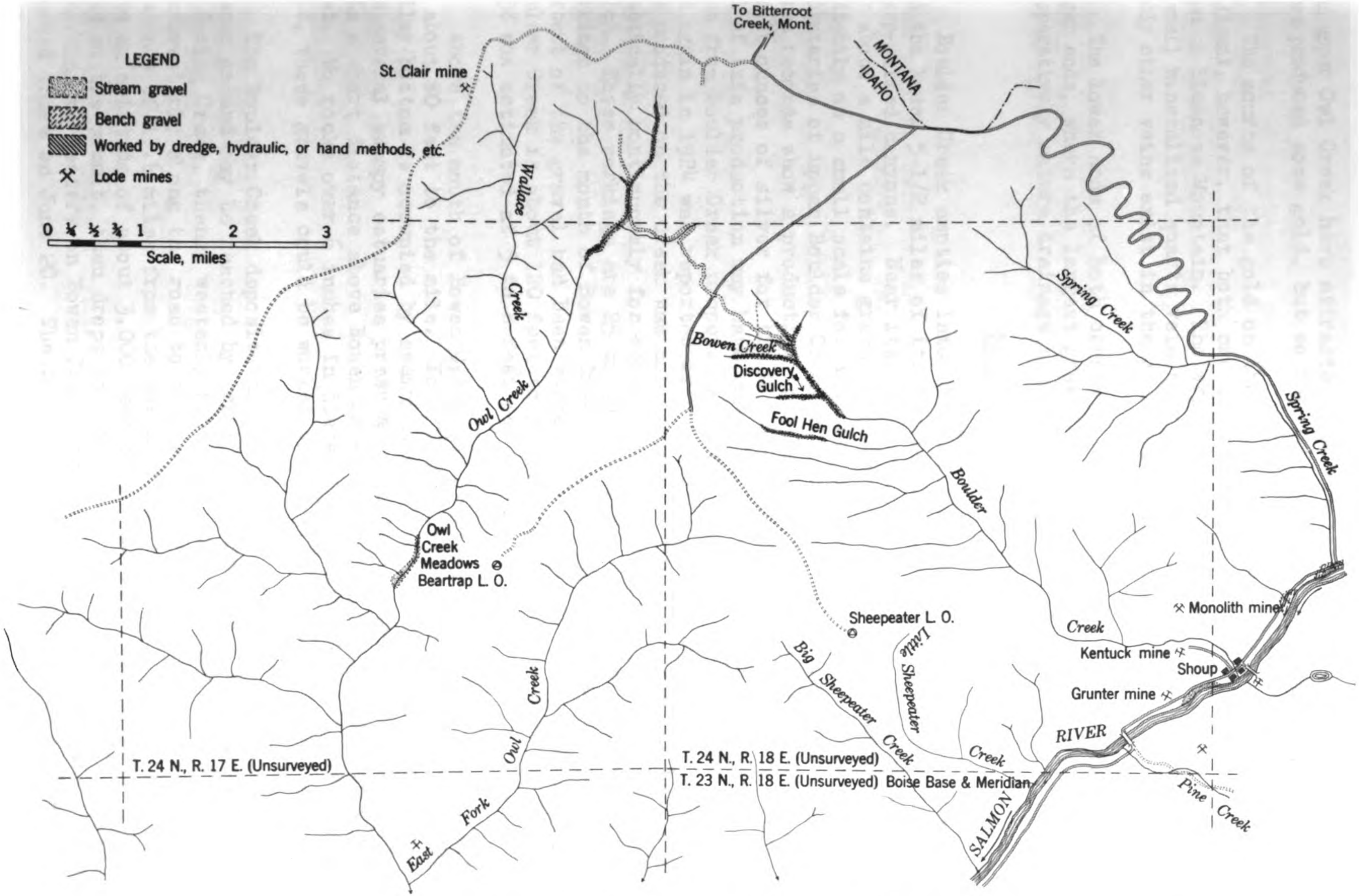

Figure 10.—Gravel deposits of the Mineral Hill district, Lemhi County, Idaho.

and upper Owl Creek have attracted some attention. The Boulder Creek gravels have produced some gold, but so far Owl Creek has been unproductive.

The source of the gold on these creeks is not obvious. It is significant, however, that both creeks drain the mineralized area south and west of Bluenose Mountain. The writers observed some old lode workings on a small mineralized quartz vein near the upper meadows on Owl Creek; probably other veins exist in the same general area.

The lower ends of both creeks flow through steep, narrow canyons. The upper ends, where the largest gravel deposits occur, occupy the bottoms of comparatively mature drainage basins.

Boulder Creek

Boulder Creek empties into the Salmon River at Shoup (fig. 10). Throughout the lower 5-1/2 miles of its course, Boulder Creek flows through narrow, steep-walled canyons. Near its upper end the valley widens slightly and for about a mile contains gravel deposits, which have been worked intermittently on a small scale for a number of years. Several small gold-bearing tributaries of upper Boulder Creek will be discussed separately. Bureau of Mines records show a production from Boulder Creek of 403.33 ounces of gold and 76 ounces of silver for the 4 years 1904 to 1907, inclusive. Part or all of this production may have come from Bowen Creek, a tributary, rather than from Boulder Creek proper. A further yield of a few ounces in 1916 and again in 1924 was reported from Boulder Creek. Undoubtedly all that was produced on the creek was not recorded. Boulder Creek has been worked practically continuously for about 1/4 mile above the mouth of Discovery Gulch. These workings are 25 to 30 feet wide. From the upper end of these workings to the mouth of Bowen Creek it is roughly estimated that about 25 percent of the gravel had been worked. The gradient along this part of Boulder Creek is about 120 feet to the mile. The stream flow in mid-July 1938 was estimated at 5 to 8 feet per second.

Above the mouth of Bowen Creek the gradient of Boulder Creek flattens to about 80 feet to the mile. For about 1/2 mile above Bowen Creek the valley bottom is occupied by swampy meadows 100 to 200 feet wide; these and several swampy estuaries presumably contain gravel deposits. Several pits a short distance above Bowen Creek indicate gravel depths of 6 to 10 feet. No rocks over 6 inches in diameter were observed. If rich enough in gold, these gravels could be worked easily with dragline equipment.

The Boulder Creek deposits are owned by F. L. Hall of Indianola. The placer ground may be reached by trail up Boulder Creek from Shoup or by road up Spring Creek, thence westerly along the summit of the divide and thence southwesterly along the road to Sheepeater and Beartrack lookouts, a total distance of 17.6 miles from the mouth of Spring Creek. This road climbs from an altitude of about 3,000 feet at the mouth of Spring Creek to 8,000 feet at the summit, then drops to 7,000 feet at the Boulder Creek workings. According to leasers on Bowen Creek, the first automobile of the 1938 season reached there on June 20. The road is closed by snow early in November.

Bowen Creek and Discovery Gulch

Bowen Creek is a small tributary of Boulder Creek (fig. 10). For 1/2 mile above its mouth Bowen Creek has been mined intensively by hydraulic methods; the workings on the lower end are obviously many years old. In 1938 some work was done on the upper end of the creek by leasers; they stated that the paystreak was very lean. The workings are from 10 to 30 feet wide and less than 10 feet deep. The gradient is about 300 feet to the mile. The gold is about 600 to 660 fine.

Discovery Gulch is a branch of Boulder Creek situated about 1/2 mile below Bowen Creek. It also appeared to have been worked upstream to the limit of profitable ground. The workings were about the same size as those on Bowen Creek.

Fool Hen Gulch

Fool Hen Gulch (fig. 10) is a small tributary entering Boulder Creek from the west about a mile below Discovery Gulch. Very little if any placering had been done along this stream until August 1938, when work was started near the upper end of the gulch about 3/4 mile east of the road to Sheepeater lookout. The workings were not visited by the writers. The description given here was furnished by the owner, D. Matlock, of Salmon.

The gravels extend about 3,000 feet downstream from where work was started. The gravel is 3 to 6 feet deep with 1 to 1-1/2 feet of topsoil overburden. Bedrock consists of decomposed granite. The creek gradient is steep enough to permit ground sluicing or hydraulicking. Testing is said to have proved satisfactory results. All of the ground is covered with a moderately heavy growth of spruce and lodgepole pine. The elevation at the workings is about 6,500 feet.

Owl Creek

Owl Creek empties into the Salmon River about 11 miles below Shoup. Two gravel deposits on which some gold has been found have been located as placer ground.

The most westerly of these deposits is known as Owl Creek meadows, hel by Torvil Bevan of Indianola. It is situated 6 miles above the mouth of Owl Creek at an altitude of approximately 5,500 feet (fig. 10). This deposit was not examined in detail.

The other deposit is situated near the head of Owl Creek at an altitud of about 7,000 feet. It is most conveniently reached from the Sheepeater-Beartrack lookout road by about 2 miles of trail. This trail is an old wagon road now out of repair. The gradient of the creek is about 120 feet to the mile. The stream flow in mid-July 1938 was estimated at 10 cubic feet per second below the forks and about 6 cubic feet per second in the main stream above the forks. The deposit is about 2 miles long and ranges in width from 25 to 200 feet; the average is about 100 feet. The gravels

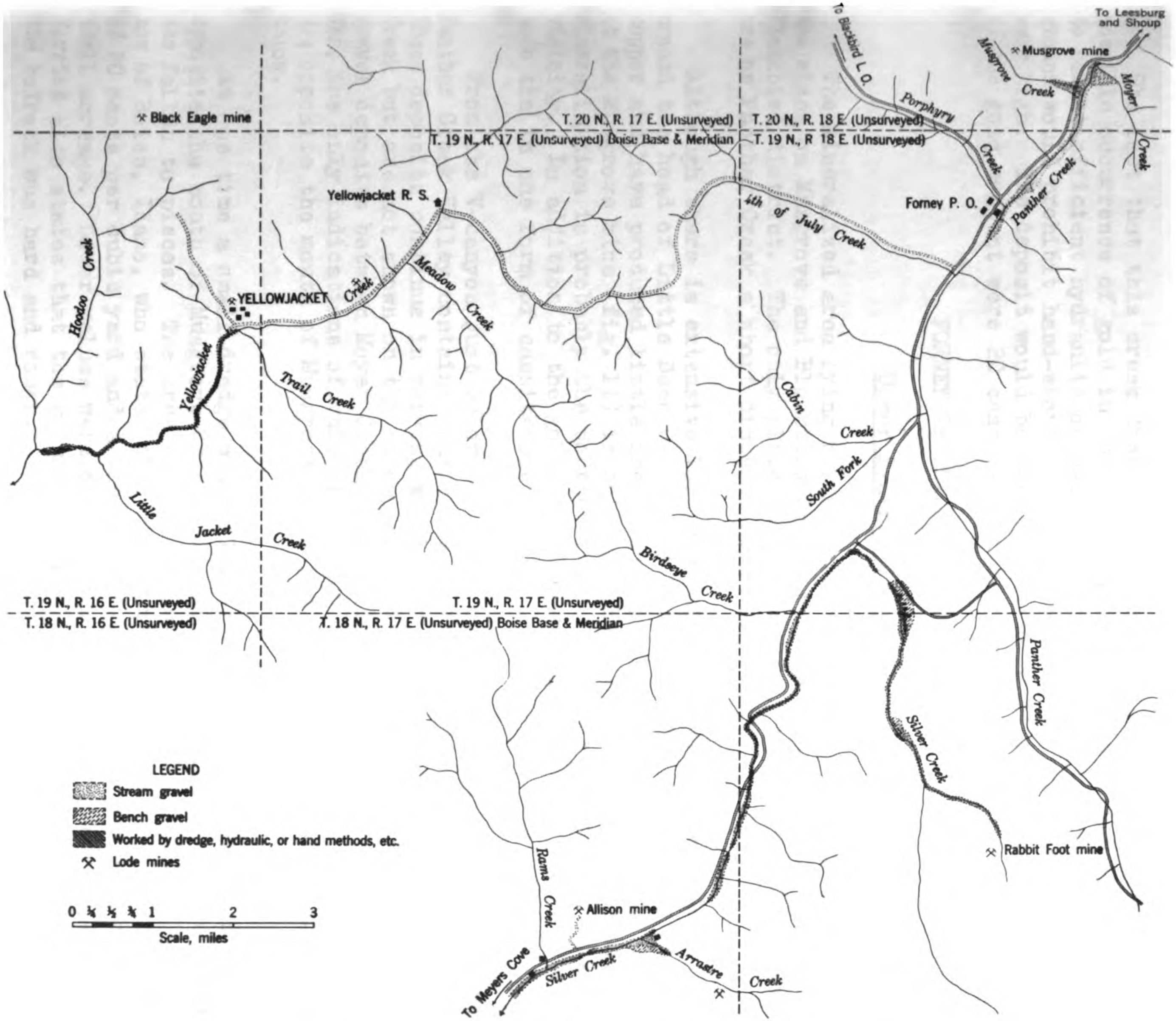

Figure 11.–Gravel deposits of the Blackbird, Yellowjacket, and Gravel Range districts, Lemhi County, Idaho.

appear to be shallow, probably not over 10 feet deep. Very few boulders were observed. A number of small test pits have been sunk along the edge of the stream gravels, but no evidence exists that bedrock in the main channel has been tested.

The fact that this creek drains a well-mineralized area suggests the possible occurrence of gold in this upper basin. The gradient is too flat to permit efficient hydraulic operations, and the swampy nature of the ground would prohibit hand-shoveling operations unless the gold content were very high. The deposit would be well-suited to small dragline operations if the gold content were 20 cents a yard or better.

FORNEY OR BLACKBIRD DISTRICT

Upper Panther Creek

The mineralized area lying north of Forney post office and including the mines on Musgrove and Blackbird Creeks was designated by Umpleby as the Blackbird district. The only placer deposits worthy of note in this area are on Panther Creek a short distance north of Forney.

Although there is extensive lode mineralization on Musgrove Creek and around the head of Little Deer Creek, the ores are valuable chiefly for copper and have produced little free gold. On the other hand, mineralization at the Musgrove mine (fig. 11) is chiefly gold. This deposit and associated mineralization is probably the source of the Panther Creek gold in this vicinity. In addition to the gold, the Forney placers are reputed to contain some tin in the form of cassiterite.

From the V-canyon just below the mouth of Moyer Creek to Porphyry Creek, Panther Creek Valley contains continuous gravel deposits 200 to 300 feet wide. These deposits continue in varying widths for a number of miles up Panther Creek but are not shown on the accompanying maps. Moreover, many other gravel deposits between Moyer Creek and Napias Creek are not included. So far, the only indications of valuable placer deposits on Upper Panther Creek are opposite the mouth of Musgrove Creek and for a short distance above and below.

At one time a small dredge was built, or partly built, on the flats opposite the mouth of Musgrove Creek. It was never operated, however, and has fallen to pieces. The area was tested some years ago by Allen C. Merrit, now of Boise, Idaho, who states that the testing indicated a gold content of 20 cents per cubic yard and a tin content of one pound per yard over a small acreage. Lower values were obtained up to the Forney Post Office. Merritt also states that the ground averaged 4 to 12 feet in depth and that the bedrock was hard and rough.

A small sample taken by the writers from a bridge-abutment excavation where the road crosses Musgrove Creek assayed 2 cents per yard in very fine gold; it contained no tin. The pay streak on which past activities centered was evidently closer to the channel of Panther Creek.

YELLOWJACKET DISTRICT

The only placer deposits in the Yellowjacket district (fig. 11) worthy of mention are those on Yellowjacket Creek below the Yellowjacket lode mine. These placers probably derive their gold in part from the Yellowjacket veins and in part from other veins in or closely associated with the granitic rocks that outcrop along Yellowjacket Creek from about a mile below the lode mines to as far downcreek as was mapped. Most rocks in the immediate vicinity of Yellowjacket are of sedimentary origin.

For about 1/2 mile below Yellowjacket the creek flows through a comparatively open valley. This section of the valley contains gold-bearing gravel deposits 100 to 200 feet wide. Near the lower end of the valley, a pit about 100 feet wide, 200 feet long, and 6 to 10 feet deep was worked by hydraulic methods. A record of the gold recovered from this operation is not available but it is believed to have been small. Above this pit the gravels are unworked; the stream gradient is too flat to favor hydraulic methods.

Below the hydraulic pit Yellowjacket Creek enters a canyon, in which it flows throughout the remainder of its course. The upper 2 miles of this canyon contains gravel deposits 20 to 50 feet wide along the stream channel. These deposits have been worked by hand methods at several points along the upper half mile of the canyon.

It may be assumed that the stream gravels below the old workings are of lower grade. The existence of pay streak on benches farther downstream, however, indicates that the stream gravels probably are gold-bearing also. The stream gravels generally are free from large boulders and consequently might be workable with small dragline equipment. The creek gradient is approximately 200 feet to the mile. The midsummer stream flow was estimated at about 16 cubic feet per second.

At several points along the canyon are a number of small bench deposits, some of which have yielded good returns to individual operators. Most of the benches are too small to map. The largest bench deposit is about 2-1/2 miles below Yellowjacket; it is about 600 feet long by 120 feet wide. It was worked in 1938 by Harry Hints and partners, who reported a recovery of 6-1/2 ounces of coarse gold from about 100 square yards of bedrock. Nearly all the gold was found in crevices in the granitic bedrock; comparatively little was found in the overlying gravel. The gravel was a few feet deep on the rim but became rapidly deeper toward the hill. Bedrock at the outer rim of the bench is about 20 feet above the creek.

GRAVEL RANGE DISTRICT

Silver Creek

The Gravel Range district, as outlined by Umpleby, includes the Rabbit Foot lode mine and the lode deposits along Rams Creek and Arrastre Creek northeast of Meyers Cove (fig. 11). The only placer mining in the district has been done along Silver Creek about 3-1/2 miles below the Rabbit Foot mi

The largest workings are situated where the Forney-Meyers Cove road first enters Silver Creek Valley about 6-3/4 miles south of Forney. The altitude here is approximately 6,500 feet. Several thousand cubic yards of gravel has been mined from a low bench on the east side of Silver Creek. These bench gravels are about 10 feet deep, including about 5 feet of topsoil; they contain very few large boulders. It is said locally that the gold is very fine and difficult to save and that this fact was one of the reasons for the cessation of operations. A considerable volume of unworked gravel remains. Narrow gravel deposits are nearly continuous downstream along Silver Creek for about 7 miles below the hydraulic workings to Arrastre Creek and upstream for about 3-1/2 miles to the Rabbit Foot mine. Except in a few places, and in a small way, these deposits have never been worked. They range from 20 to 100 feet in width; their average width is probably less than 40 feet. They are apparently shallow but usually are free from large boulders. It is conceivable that parts of them may be workable with small dragline equipment.

The gradient of Silver Creek is close to 200 feet to the mile. The stream flow in late August 1938 was estimated at between 1 and 2 cubic feet per second.

Stream-gravel deposits at the mouth of Arrastre Creek are about 600 feet wide but narrow to 50 feet or less about 600 feet above the mouth. This deposit evidently is deep but has not been tested. There is also some bench gravel on the south side of the confluence of Arrastre and Silver Creeks. Reese Mills holds some placer claims at the mouth of Arrastre Creek.

Below Arrastre Creek the Silver Creek Valley contains bottom lands 100 to 200 feet wide, which are being used as farm or grazing land; they have aroused little interest as placer ground. They were not mapped below the mouth of Rams Creek (fig. 11).

SALMON RIVER

General Discussion

Gold-bearing gravels occur at intervals along the entire course of the Salmon River from its source in southwestern Custer County to its mouth in western Idaho County. That part of the river lying in Idaho County has been described in a previous paper[14]. Custer County will be described in a future paper.

The Salmon River flows through or along the border of Lemhi County for slightly over 100 miles of its course. Throughout nearly all of this distance it is closely paralleled by an all-year automobile road. The lower 30 miles of this road is still under construction but is open to travel.

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[14] Lorain, S. H., and Metzger, O. H., Reconnaissance of Placer-Mining Districts in Idaho County, Idaho: Inf. Circ. 7023, Bureau of Mines, 1938, p. 79.

Gold lodes and tributary gold placers have contributed gold to the Salmon River almost from its source. Consequently, some gold may be found in gravels anywhere along the river. In Lemhi County, however, concentrations of commercial interest apparently are confined to that part of the river lying downstream from the drainage of the local gold-mining districts.

The part of the river between North Fork and Shoup (or possibly down to Panther Creek) is of most interest to placer miners. Many bench deposits below North Fork have been worked in a small way and often have yielded good returns. Only recently the river canyon below Panther Creek has been opened to automobile travel. Because of lack of roads, prospecting in the past probably has been less thorough below than above Panther Creek. Little or no placer mining has been attempted along the Salmon River in Lemhi County above the North Fork, through which the drainage from the Gibbonsville mining district enters.

The maps and descriptions given in the following pages will deal only with that part of the river below the mouth of Fourth of July Creek (fig. 6). Although the largest gravel deposits are farther upstream, it is probable that such gold as may have found its way down from the Custer County gold fields or has been contributed by the few gold-bearing streams in Lemhi County above this point has been too widely disseminated over the large areas of river bottom to be of commercial interest.

Stream Gravels Along the Salmon River from North Fork to Middle Fork

Very little definite information is available as to the gold content of any of the stream gravels along the upper Salmon River. Although undoubtedly these gravels have been prospected, probably no systematic testing has been done. The fact that gold is found in appreciable quantities in many of the bench gravels of stream origin just above the present stream bed would indicate that the present stream gravels are gold-bearing.

The bottom land, which includes the stream-gravel deposits, has been mostly patented as agricultural land and is being used for farm purposes. Some of it is covered by placer-mining claims, but most of this is also being used for farming.

Stream gravels extend upstream on both sides of the Salmon River from North Fork to within 1/4 mile of Fourth of July Creek (fig. 6). The largest deposit is on the east side of the river and extends from Wagonhammer Creek upstream for about 2 miles. It ranges in width from a few hundred feet to over 1/4 mile. On the west side of the river, just opposite Wagonhammer Cree is another deposit about a mile long and about 1,500 feet wide in the widest place. It is not known whether or not either of these deposits has ever been tested for dredging possibilities. Gravels of commercial grade have been found along Fourth of July Creek on the east and also along the small unnamed creek on the west side of the river just opposite Fourth of July Creek. In view of this, there is little doubt that the large stream deposits just below contain some gold. It seems improbable, however, that enough gold could be

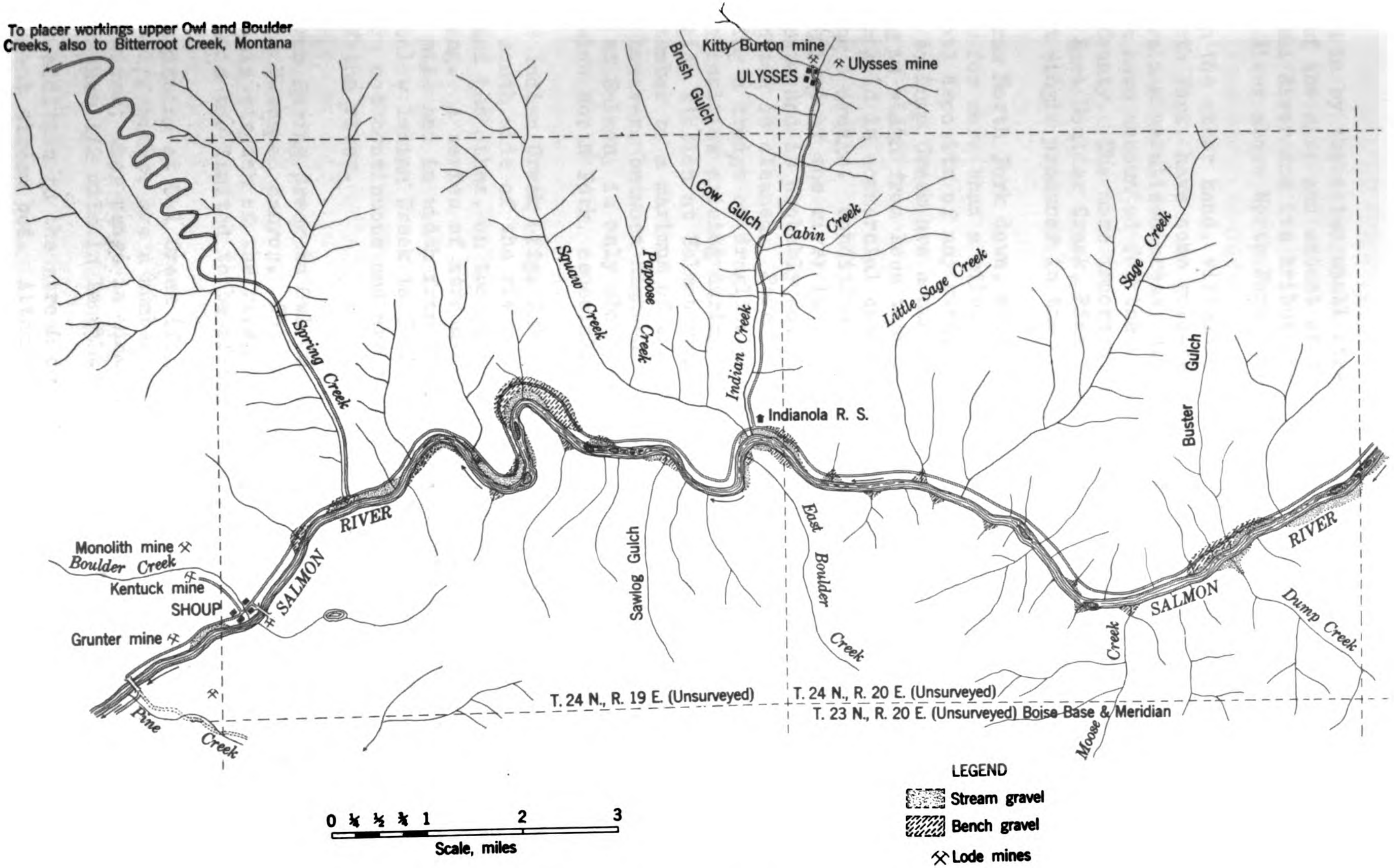

Figure 12.—Gravel deposits of Salmon River from Dump Creek to Pine Creek, Lemhi County, Idaho.

brought in by these two small streams to form gravel deposits of commercial grade of the size and extent of those just described. With the exception of the Lemhi River and its tributaries, none of the streams that empty into the Salmon River above North Fork have large placer deposits.

On the other hand, virtually all of the tributary streams below, including North Fork, have some gold-bearing gravels of commercial grade. Many of them drain mineralized areas; along some of these streams rich and extensive placers have accounted for the major part of the placer-gold production of Lemhi County. The more important of these tributaries are North Fork, Moose Creek, East Boulder Creek, Pine Creek, and Panther Creek. Napias Creek, the largest single producer in the county, is a tributary of Panther Creek.

From North Fork down, neither the stream nor the bench deposits are continuous for more than a mile. In many places, stretches of several miles have no gravel deposits of any kind. Beginning at North Fork and extending downstream to Dump Creek are a number of deposits on both sides of the river ranging in width from less than 100 up to about 600 feet. Assuming that they contain gold in commercial quantities, they may have enough yardage to justify building a dredge. Conditions generally appear to favor operation of a dredge. The gradient of the river is about 10 feet in a mile. The bedrock is schist or granite and is probably soft enough so that 3 to 6 inches could be taken when bottom is cleaned. Perhaps the most unfavorable feature involved in operating a dredge or dragline plant anywhere on the Salmon River would be the difficulties arising during the flood season. The daily discharge at the gaging station at Salmon ranges from a minimum of about 760 second-feet in September to a maximum of over 8,000 second-feet in June. The vertical range, however, between high-and low-water mark, as indicated by the gage height at Salmon, is only about 4 feet. It is probably much greater than this below North Fork, especially in places where the canyon is narrow.

At Indian Creek (fig. 12) are two small deposits of stream gravels; one, on the south side of the river, is about 150 feet wide and about 1/4 mile long, and the other, on the north side, is about 200 feet wide and about 3/4 mile long. A series of stream-gravel deposits ranging in length from 1/2 to 3/4 mile and in width from 200 to 500 feet extends downstream from about 2 miles below Indian Creek to Spring Creek, a distance of about 3-1/2 miles. They are not continuous and are partly on the north and partly on the south side of the river.

From Spring Creek to Owl Creek (figs. 9 and 12) the river flows through a narrow V-shaped canyon. The only stream-gravel deposit worth mentioning along this stretch of the river is on the north side just below Shoup. The yardage is too limited to be of any commercial importance.

Beginning at Owl Creek (fig. 12) and extending downstream to Colson Creek, about 4-1/2 miles, are a number of small deposits, mostly on the north side of the river; they range in width from 100 up to about 400 feet. The largest is less than 1/2 mile in length.

In addition to the stream deposits described above are the gravels of the present stream bed. Attempts to dredge the bottoms of large streams generally have been disappointing, unless the water could be diverted. Bucket-line dredges or drag-line plants probably would be impractical in streams having rapid currents. Much experimenting has been done with suction dredges but, so far as is known, none of these have been successful in recovering gold from river gravels. Besides this, there is always the danger of large floating plants of any kind being pulled from their moorings during flood seasons.

In the summer of 1938 a suction dredge was being tested on the Salmon River several miles below the town of Shoup. The river at this point is 200 to 250 feet wide. The current is not as swift as at most places, and there are no rapids for more than 1/2 mile. The owner of the plant, Colen Smith of Spokane, Wash., states that the gravel is 5 to 9 feet deep, with very few boulders larger than 1 foot in diameter.

The plan is to treat only the fine gravel on bedrock. This material is to be sucked through a 6-inch pipe, the end of which is pointed and perforated with about 3/4-inch holes. A heavy spiral is fastened around the outside of the pipe so that it can be screwed into the gravel to bedrock. It is connected with a power unit on the boat through a flexible coupling so that it can be operated at any angle. It is thought that if it is operated at an angle of 30° to 45° with the horizontal it will "crawl" along on bedrock as it is turned, dragging the boat with it. The boat, however, is provided with shore lines and can be moved back and forth across the river independently of the screw mechanism. Suction is provided by a 5-inch centrifugal rock pump connected to the pipe by a 6-inch hose. All gold-saving equipment is on the scow.

The beds of all navigable streams are excluded from all mining and agricultural claims located and acquired under the Federal laws. They are available for exploitation, however, under the State laws. An act[15] of the Idaho State Legislature in 1937 provided for leasing to individuals and corporations the bottoms of all navigable streams in the State.

Bench Deposits Along the Salmon River from North Fork to Middle Fork

Almost all recent gold production from along the Salmon River has been from bench-gravel deposits 25 to 75 feet above the river (figs. 6, 9, and 12). Those of probable commercial values are shown by broken cross hatching and shading; those of questionable value by broken cross hatching only. Many of the deposits of questionable value are torrential fans at the mouths of tributary streams. They consist mostly of large, angular rock fragments and other detrital material brought down by the tributaries during heavy run-off. Most of the material unquestionably is not gold-bearing. It is possible, however, that in some places it rests as overburden on bench gravels of stream origin containing appreciable quantities of gold.

The deposits shown as having probable commercial value as placer-mining ground consist largely of well-rounded gravel of stream origin. Well-rounded boulders 1 to 3 feet in diameter are common in nearly all of the deposits, although they are much more predominant in some places than in others. Large angular rock fragments and soil from the adjacent mountain sides form an overburden on nearly all of the deposits. In places this overburden could be handled along with the gravel without excessive cost. In other places it is a serious handicap, and only exceptionally rich gravels could be mined successfully.

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[15] Campbell, Arthur, and Breshnahan, Leo, Mining laws of the State of Idaho. Published in July 1937.

The bench deposits, like the stream deposits along this section of the river, are scattered and lack continuity. They are present on both sides of the river but mostly on the north. The largest areas are at Dump Creek, 2 miles due west of Indian Creek (fig. 12), and between Owl Creek and Colson Creek (fig. 9).

Until recent years comparatively little attention appears to have been given to these deposits. During 1936, 1937, and 1938, more than the usual amount of prospecting has been done, as well as some placering on a small scale. A very significant fact is that gold in appreciable quantities, and in some cases paying quantities, seems to have been found wherever prospecting was done with diligence and judgment. In spite of this, however, only a very few of the attempts at placering have been successful.

Mining costs at best will always be relatively high; first, because of the overburden and large boulders to be handled and second, because of the expense of bringing water to the gravels under adequate head for hydraulicking. Ground sluicing has been successful; probably the most satisfactory method would be hydraulicking, with water supplied by Diesel-powered pumps. Lack of placer-mining experience and the lack of capital for installing adequate equipment for moving a large yardage, probably have contributed largely to most failures in recent years.

In the summer of 1938 about 15 men worked along the river between North Fork and Middle Fork. Two parties worked above Shoup on the north side of the river - one opposite Dutch Oven Creek on the south side of the river and one just below Cove Creek on the north side of the river.

The Golden Queen placer mine, on the north side of the river just below Cove Creek, is owned and operated by Wm. McCafferty and three associates of Salmon, Idaho. The gravels are on granite bedrock about 25 feet above the Salmon River and consist of about 20 feet of well-rounded gravel with an overburden of about 10 feet of large angular fragments of granite mixed with topsoil. Very few of the boulders in the gravel are as large as 1 foot in diameter, but much of the overburden consists of rocks 3 to 5 feet in diameter. Some gold is disseminated throughout the gravel, but most of it is concentrated in 3 to 5 feet of the material nearest the bedrock. Panning of material near bedrock indicated gold values of between 75 cents and $1 per cubic yard. One small sample taken by the writers ran $2.60 per cubic yard. The average of all the gravel is of much lower grade than this, of course. Ground-sluicing operations were begun in July 1938. Water was pumped to an 300-gallon tank equipped with a gate that opened automatically when the tank was filled, suddenly releasing water for ground sluicing. The water was pumped to a height of about 55 feet with a 1-1/2-inch centrifugal pump powered by a 6-horsepower gasoline engine. About 8 minutes was required to fill the tank. The gravel was run through a sluicebox about 50 feet long; the first 25 feet was equipped with pole riffles and the last 25 with metal lath and burlap.

The operation on the south side of the river opposite Cove Creek consisted of hand-shoveling ahd hauling with wheelbarrows to a sluice box. The deposit consists of a filling of fine gravel and soil around large boulders up to 6 feet in diameter. About a yard of this material could be mined and sluiced in a day by one man. Mint returns indicate that the gravel handled ran from $3 to $5 per cubic yard. The operation is of importance only in that it shows the possibility of the existence of other high-grade deposits along the river.

SUMMARY

The several phases of the placer-mining situation in Lemhi County may be summed briefly as follows:

Bucket-line dredging. To date there has been relatively little dredging in the county. Only two streams, both in the Salmon district, have been dredged on a large scale. Another dredge was operated for several years in the Mackinaw district, but its output was relatively small. Unworked ground of probable value for dredging remains in the Salmon, Gibbonsville, and Mackinaw districts. Most of tho individual deposits, however, are too small to repay the installation of a large bucket-line dredge. Consolidations of several properties to be worked successively by a dredge of portable size might be profitable. There are a few individual properties that might be successfully worked by small bucket-line dredges.

Dragline plants. - These have not been given serious trial in the county In addition to the possible dredgeable ground mentioned in the preceding paragraph, there are a number of gravel deposits in the Gibbonsville and Mackinaw districts that, although never adequately tested, appear to present possibilities for dragline plants if run by skilled and adequately financed operators. Smaller deposits, usually of doubtful value but which may be workable by dragline, are present in the Forney, Yellowjacket, Gravel Range, and Shoup districts as well as in the two districts first named.

Hydraulicking. - Hydraulicking of bench and stream gravels has accounted for most of the placer production of Lemhi County. Large areas have been worked by this method in the Mackinaw, Gibbonsville, and Salmon districts. Nearly all such areas, which could be worked at $20.67 gold, were exhausted by the early miners. However, there are some fairly large deposits that may be workable with gold at $35 per ounce in the Gibbonsville and Mackinaw districts. The Mackinaw district also contains some large deposits of bench gravel generally believed to be of subcommercial grade but that might contai hitherto undiscovered pay streaks. Some high gravels in an arid section of the Salmon district may contain enough gold to be workable by hydraulic or dragline methods if adequate water could be brought to them.

Shoveling, ground-sluicing, and small-scale hydraulic operations. - These are being conducted successfully at a number of places in Lemhi County in spite of the fact that deposits rich enough to be worked in this manner have, as in other placer districts, been intensively prospected and worked. The relative inaccessibility and small population of Lemhi County has retarded prospecting and mining to some degree. There are still opportunities for a limited number of experienced men to make wages or grubstakes around the margins of old workings or on ground too low grade to be attractive to the early miners. At one place good pay was recently discovered on a creek never before worked. Opportunities for operations of this type are confined chiefly to the Mackinaw district or to the benches along the Salmon River below North Fork.

Transportation facilities. - These are generally good in the Salmon district and in most parts of the Gibbonsville district but are adverse in other districts, except in favored localities, during good summer weather. Roads to outlying districts have been improved greatly in recent years.

Climatic conditions. - These vary widely. Winter temperatures and snowfall are moderate along the Salmon River but become increasingly severe at higher altitudes where placer operations in winter are generally impossible. Nearly all placer-mining districts in the county are plentifully supplied with water.